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The Home Life of Wild Birds



A New Method of the
Study and
Photography of Birds

By

Francis Hobart Herrick

Revised Edition

With 160 Original Illustrations from Nature
by the Author

G. P. Putnam's Sons

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TO THE MEMORY
OF
MY FATHER AND MOTHER



COME LET US LIVE WITH THE BIRDS !

PREFACE TO THE REVISED EDITION

IN revising this work on *The Home Life and Activities of Wild Birds*, much has been re-written, and forty-eight new illustrations have been added to the text in place of a smaller number omitted. The first three chapters have been materially changed; Chapter XI. on *Nest-Building* is entirely new, as are also in large measure those which follow on *The Development and Care of the Young* and on *Life and Instinct*.

These observations were chiefly made in central New Hampshire, in the towns of Northfield and Tilton. Precise names of all species mentioned in the text are given in the Index.

The semi-technical parts will naturally appeal most to students, but I hope they will not be without interest to the general reader.

The field of animal behavior in the direction of both observation and experiment is of boundless extent, while on the side of inference it is full of pitfalls. Even if I have not successfully avoided the latter in every case, I have been continually on my guard.

My thanks are specially due to the publishers of this volume, who have forwarded my wishes in every possible way. I am also indebted to the editors of the *Century Magazine*, and of *Bird Lore* for permission to use certain material which has already appeared in their pages, and to all critics of the earlier edition who have appreciated my efforts.

WESTERN RESERVE UNIVERSITY,
CLEVELAND, OHIO, March, 1905.



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INTRODUCTION

I

TO describe and illustrate a new means of studying animal behavior, and to record what has been learned by its aid concerning the strenuous life of the wild bird, are the main purposes of this volume. It is a popular study of birds in action and is chiefly concerned with the homes or nests and their occupants.

While the desire has been present to make these pages readable, no effort has been spared to render them accurate. Many of the observations are new; nearly all are original, and every statement of fact is believed to be true as it stands.

The wish to give a human interest to every phase of animal activity is of very ancient origin and has done too much already in spreading the seeds of popular error and superstition concerning animal life and lore. Animals should be studied as animals which they are, and not as human beings which they have never been and are not likely ever to become.

The constant reading of human attributes into the activities of animals is to begin at the wrong end, and is a drag on the progress of accurate knowledge. We should first study the animal as far as possible from its own standpoint, and learn with exactness the facts of its life, taking care not to press analogies farther than the observed facts will warrant. Ignorance of anatomy as well as of physiology, and the desire to find in the doings of animals a marvelous counterpart of human powers of intelligence and reason, have already stocked our libraries with fables, anecdotes, and stories, which make pleasant reading, but possess little value for the modern student.

The first duty of the narrator of natural as well as civil history is to tell the truth, and to the naturalist belongs also the privilege of showing that the lives of the higher animals, when fully and clearly revealed, possess a more vital interest than the puppet dressed in human clothes, however admirable the latter may be as a work of art.

I trust that the reader will not misunderstand these remarks. What is criticised is the gross anthropomorphism which characterizes much that is written upon the actions of animals. If I am an offender in this direction, I hope it is only in a minor degree. I am anxious to attribute to the animal every power which it is actually known to possess, and look for the roots of human instinct and intelligence all along the line of animal evolution. "Go to the ant, thou sluggard!" is good advice, but one should bring from the ant a trustworthy account of how it performs its wonderful works.

II

Although this is not a treatise on Animal Behavior, a general working theory has been adopted, and is given in the chapter on *Life and Instinct*. If it were possible to add a select bibliography on the instincts and intelligence of animals, the list would include the names of more than a dozen modern writers, whose works abound in fertile suggestions and ideas. To have quoted from their experiments or technical essays would have taken us far from the scope and purpose of the present volume, and to a study of forms as far removed from Birds as the higher Mammals on the one hand, and the Insects or the Protozoa on the other. In such a list, however, would occur the names of Karl Groos, Lloyd Morgan, Edward Thorndike, and Professors Whitman and Loeb, to mention those to whom I am most indebted, and whether we accept their theories or not, they must command our respect, because they are based on the secure ground of observation and experiment.

All earnest students should ponder well the words of Karl Groos, who maintains, in his admirable work on *The Play of*

Animals, that the interpreter of the animal mind should unite to a thorough training in physiology, psychology, and biology the experience of a director of a zoölogical garden, and the lore of a forester, besides being a student of æsthetics. Such versatility is practically unattainable, but even if he magnifies his office, it is not surprising that much has been written to so little purpose on a difficult subject.

III

A number of years ago I became interested in the photography of wild animals as a means of securing better pictures for book-illustration, but it was not until the summer of 1899 that time was found for experiments in the field. Taking up the specific problem of how to photograph the free wild bird, it was at once apparent that the nest or home was the focal point of interest to both bird and observer, since during the period of nesting or home life the range of the adults is limited as at no other time, and to a comparatively small area. For a month or more they are chained to a given spot. It was also evident that for the study of any nest, situated near the ground and within reach of the camera, a convenient and perfect means of concealment was necessary. A glimpse now and then, or a "lucky shot" obtained by means of attaching a long rubber tube with pneumatic bulb to the shutter of the camera, which must be worked at a distance, is not of much value. What was needed was a means of watching at the closest range the whole life of birds at the nest.

For concealment I first decided to try a house made of light boards and painted green, but soon discarded this impracticable idea and made a tent of green cloth instead. This was used at a nest of Redwing Blackbirds, situated a few feet above the water of a swamp, and was a success from the first. However, the task was only half completed with the introduction of a convenient blind, since most nests of wild birds are inaccessible from the ground.

The next experiment was made with Chipping Sparrows,

whose young left their nest the moment it was disturbed. The branch which held this nest was thereupon sawn off, and mounted in a convenient spot beside a barn which happened to be near, one of the young being used as a lure. While this nest was being moved, I placed the fledgling under an old-fashioned wire screen used to cover food, when the mother, true to her parental instinct, came promptly with an insect and alighted on the wire net. Some photographs were later made, but, although in this case parental instinct was the force employed, the displacement of the nest had no significance.

The first experiment in moving the nest, branch and all, was made upon Cedar Waxwings, August 3, 1899. Two days later the tent was pitched before their nest, and in a few minutes I had the pleasure of seeing both birds approach and feed their young with choke-cherries by regurgitation, as if nothing had happened. The scenes were as fascinating as they were novel, and a number of photographs were made from the tent, one of which is reproduced on page 89 of this work. It thus became evident that an important principle was involved, and that the key to the problem of approaching the wild bird had been found. Every subsequent experiment tended to confirm this conclusion.

The method is based on the solid ground of animal instinct, is capable of many refinements, and in judicious hands will add wonderfully to our knowledge of birds during that most interesting of all periods—life in the home.

IV

With the opportunities of closest approach which this method affords, it has been possible to give an exact analysis of nest life. Attention will be called to the chain-like relation of the different serial acts performed at the nests, such as the capture and delivery of the prey, the inspection and cleaning of the nest, and brooding and spreading over the young. We have found the same type of behavior recurring with striking regularity in those orders of birds already studied, which feed their young for a considerable period, but the field is wide and unexplored

in many directions, and we must look for much variation in all minor details.

The strength of parental instinct, especially in the higher animals, has been recognized from early times, but the subject has not been previously subjected to careful experiment and analysis in birds.

I have found but few references to even casual experiments. In speaking of the Catbird, Audubon observes that it will sit on its eggs after the nest has been displaced, or even after it has been carried from one bush to another (*Ornithological Biography*, vol. ii., p. 173). Blackwall, in a later English work (referred to on page 189), gives a good example of the strength which the parental instinct in even a foster-parent sometimes attains. He relates that in August of the year 1825 a neighbor took a young Cuckoo out of a Titlark's nest, carried it home, and put it in a cage, which was hung in a pear-tree in his garden. The foster-parents quickly discovered their nursling, notwithstanding that it had been carried three quarters of a mile from its home, and continued to feed it until it was killed by a cat.

In another instance, mentioned by Montagu (*Ornithological Dictionary*, p. 203), a nest of Golden Crested Wrens was moved from its original position, and the old birds were enticed to his study-window, and finally inside the room. The male would never enter, but his mate fed her young—in their nest which was placed in a basket—on the table at which he sat, and even when he held the nest in his hand, provided he was perfectly motionless. Such stories no longer occasion surprise, and will receive ample illustration in the pages which follow.

V

This study of the activities of birds, which was further undertaken as a relief from the confinement of a laboratory, soon developed from a holiday recreation into most serious work, but the chief difficulty under which I have labored is lack of time.

The season most valuable to the student of the life and

instincts of birds is definitely fixed in this latitude, and extends from the middle of April to the middle of July, while two or three weeks could be advantageously added at either end of this quarter-year period. My professional duties have always kept me at my post until most of the golden opportunities of the year were lost, so that the work had to be done at the lag end of the season.

In no other study is continuous effort at a particular time more essential. A rare chance may come in May or June, but if one is interrupted or called away for a day or even for an hour, it may be lost and never return. To obtain the best results, the student of the life and instincts of animals must be a free lance, and unhampered by the burdens and conventions of life. At some future time, I hope to offer a fuller account of my observations.

VI

For comparison with the modern results of photography, I am able to present reproductions of the most ancient pictures of the home life of birds which have come down to us.

The oldest representations of nesting birds introduce us to the celebrated hunting scenes of the ancient Egyptians, in which their spirits are pursuing the favorite sport of hunting in the reeds and the marshes of the Nile. These were cut in stone-relief and colored, on the walls of famous tombs in the neighborhood of Memphis. They date from the Fifth Dynasty and are considerably over four thousand years old. In the papyrus thickets fly birds of many kinds, while others sit on conventional saucer-shaped nests, which are balanced on the flowers of this plant. (See Fig. 109.)

But more interesting than these is a painting in colors on the wall of a tomb, probably of the Eighteenth Dynasty, and over three thousand years old, recently discovered at Kurna, Thebes, and first placed on exhibition in March, 1904. (See p. xxiii.)

The drawing which is here given represents the detail of a remarkable tree, in which the artist has represented in different registers the foliage, the trunk and branches, and a vine (grafted

on to the tree), bearing large clusters of purple grapes. In the branches we behold birds' nests with eggs, while higher up is this nest containing four young birds nearly full-fledged. The spirited original, which is better than many drawings produced in modern times, represents the nestlings at the critical moment of being fed. The parent, doubtless a Pigeon, is coming full tilt toward the nest, while her young, with their necks upstretched, mouths agape, and wings a-quiver, are calling eagerly.



Nest life of birds as represented in Egypt seven hundred years before the traditional founding of Rome.

Three other birds, and five other nests, containing either two or three eggs, appear in this or adjoining trees. Since Pigeons lay but two eggs, our ancient artist has overstepped the bounds of ornithological accuracy, but the picture is of remarkable interest, and is the oldest elaborate drawing of nest life yet recorded, and the best to be seen on the Egyptian monuments.

The conventional form of the birds' nest (a saucer, or crescentic figure with rounded horns), which had been in use for nearly fifteen hundred years, as is proved by existing remains,

has been retained, with cross-hatching added, while the drawing of both young and adult birds is taken direct from nature. The picture was the work of a man competent to observe, and skilful with the brush, but without the motives of scientific accuracy, and hampered by those curious conventions of art which the ancient Egyptians were never able to wholly shake off.

VII

Nearly all the illustrations of this volume are from photographs of adult birds, and in some cases are arranged in series, and portray certain actions which are performed in routine. With very few exceptions all were made by means of the method—that is to say, the photographs were taken deliberately and not by chance. My plan is to watch the life at the nest very closely, hour by hour, and day by day, and I often make a large number of photographs to illustrate typical and unusual scenes at a nest. The observer has the advantage of being on the spot, of being able to see every act performed, and to seize every opportunity which may arise. Many of the photographs here shown could not have been obtained by any other means.

Among the water birds, this method has been most fully applied to the Great Herring Gull, the communal life of which, with the many singular attitudes assumed on the perches and about their preserves, can be represented in the fullest detail, but the results of these studies will be offered at some future time.

For portrayal of animals in action the camera is of value, because of the very exactness with which we are able to catch and register a fleeting attitude or expression as well as the varied series of bodily acts which are the momentary witnesses of the instinct and intelligence of animals. The camera is an impartial observer and taker of notes, and a kind of third eye to which we may appeal when in doubt. However great its limitations, they are of a different character from those of the actual observer. The photograph is not to be foolishly vaunted over the work of the artist, for the camera supplants or replaces nothing; it is a

tool, a trusty servant and recorder, which the artist can use to as good advantage as any one else. Scientific books dealing with the anatomy and development of animals will always require good drawings for the illustration of their subjects, and these are preferable to poor photographs; but for the study of animal behavior in both the invertebrates and vertebrates the camera is at times immeasurably superior to brush or pencil. Popular natural-history books have already a large body of invaluable material to draw upon for illustrative purposes, and the often crude, impossible, or imperfect drawings, which have long done service in the past, will gradually give place to truthful delineations of animals at home, and in the midst of that nature of which they form a part.





THE HOME LIFE OF WILD BIRDS

CHAPTER I

A NEW METHOD OF BIRD STUDY AND PHOTOGRAPHY

THE method of studying the habits of wild birds which this volume illustrates consists in bringing the birds to you and then camping beside them, in watching their behavior at arm's length and in recording with the camera their varied activities. By means of such a method one may live with the birds for days at a time, and watch the play of their most interesting habits and instincts. The actors are not confined in cages; they suffer indeed no restraint, excepting that only which their nature imposes. They come and go at will, and their life is as free and untrammelled as ever.

The method enables one to see with his own eyes at a distance of a few inches or feet, more or less, what birds do in and about their nests, and at the same time affords the rare opportunity of making photographs, not a single picture or a chance shot now and then, but an unlimited series of pictures to illustrate the behavior of birds in the fullest manner and at the most interesting period of their lives. It is often an easy matter to focus the camera directly upon the bird itself and to give a time exposure when desired. Moreover, you can approach as near as you wish, and make photographs of any required size.

Wild Birds

I will now give the reader a less enigmatical account of the method, first considering its psychological basis or the scientific principles on which it rests, and then recording in a separate



Fig. 1. Tent in front of Cedar-bird's nest, shown in its original position in Fig. 12. One of the birds is feeding its young.

chapter, as practical examples of its working, the exact history of a few of the cases in which it has been applied.

The method in use depends mainly upon two conditions:

- (1) The control of the nesting site, and
- (2) The concealment of the observer.

By nesting site is meant the nest and its immediate sur-

roundings, such as a twig, branch, hollow trunk, stem, or whatever part of a tree the nest may occupy, a bush, stub, strip of sod or tussock of sedge, that is—the nest with its immediate settings. If the nest, like that of an Oriole, is fastened to the leafy branch of a tree, the nesting bough is cut off, and the whole is then carefully lowered to the ground and set up in a good light, so that the branch with

**Control of
the Nesting
Site**



Fig. 2. Tent in bushy pasture beside nest of Chestnut-sided Warbler, shown in detail in Fig. 3.

the nest shall occupy the same relative positions which they did before. The nest, however, is now but four instead of forty or more feet from the ground.

The nesting bough is carried to a convenient point, and firmly

fastened to two stakes, driven into the ground and placed in a good light. If the nest is in a tussock in a shaded swamp, the



Fig. 3. Tent beside nest of Chestnut-sided Warbler. The female broods, while the male is foraging.

whole is cut out and taken to the nearest well-lighted place; if in the woods, it is carried to a clearing where the light is favorable for study. Again, when a nest like that of the Brown

Thrush occupies the center of a dense thorn bush which no human eye can penetrate and much less that of the camera, its main supports are cut off, and the essential parts are removed to the outside of the clump or to any favorable point close at hand. If the nest is but five or ten feet up, the main stem is severed, and the nesting branch lowered to the four-foot mark, a convenient working height.

I wish to emphasize the fact that the nest itself is usually not moved or disturbed, or rather that it is moved only with its supports. The change is one of space relations, which may change with every passing breeze, but the relation of nest to support remains undisturbed.

This sudden displacement of the nesting bough is of no special importance to either old or young, provided certain precautions are taken to be dwelt upon a little later. It is as if an apartment or living room were removed from the fourth story of some human abode to the ground floor, or in the case of the ground-building birds as if the first story were raised to a level with the second. The *immediate* surroundings of the nest remain the same in any case. The nest might indeed be taken from its bough or from the sward, but this would be inadvisable, chiefly because it would destroy the natural site or the exact conditions selected and in some measure determined by the birds themselves.

For an observatory I have adopted a green tent which effectually conceals the student together with his camera and entire outfit. The reader will find this fully described in the chapter on the tools of the bird-photographer. The tent is pitched beside the nest, and when in operation is open only at one point marked by a small square window, in line with the photographic lens and the tent.

Conceal-
ment of the
Observer

It seems at first thought strange and almost incredible that one may take such liberties with wild birds, without wreaking destruction upon the young or introducing such unnatural conditions as would be intolerable to every true student and lover of birds, but this is by no means the case. No injury is wrought upon old or

Principles
which underlie the
Method

young. The former nesting conditions are soon forgotten, while the new are quickly adopted and defended with all the boldness and persistence of which birds are capable.

This method of studying birds depends mainly upon the strength of the parental instincts which bind old to young by an invisible chain, and upon the ease with which a bird learns to adapt itself to new conditions. Upon more complete analysis we recognize the following psychological principles:

(a) The strength of an instinct increases through exercise, and may be reënforced or temporarily replaced by habit;

(b) An instinctive impulse may be blocked or suppressed by any stronger or contrary impulse;

(c) The instinct of fear is often temporarily suppressed by the fighting instinct, or permanently overcome by the repetition of any experience leading to the formation of new habits or associations.

We may also add:

(d) New habits are readily formed and reënforce or supplant those of older growth;

(e) Abstract ideas, if they form any part of the furniture of the average bird-mind, are extremely hazy and fleeting;

(f) Finally we must recall the physiological fact that birds are guided in most of their operations by sight and hearing, not by scent. Their olfactory organ is very rudimentary at best, and avails them neither in finding food nor in avoiding enemies.

After a brief analysis of the parental instincts we will endeavor to show how the principles just given are applied to the problem of approaching wild birds in the way described.

The parental instincts begin to control the life of the adult with the periodic revival of the reproductive functions, and vary greatly in their scope and intensity at the different stages of their reign as well as in different species of birds. They are periodic, recurring at definite intervals during sexual life and in serial form, one kind of act usually leading to the next in sequence, and so on until the series is complete.

When more than one litter is produced in a season, the series of events is repeated with minor changes. If we include

Method of Bird Study and Photography 7

the typical migratory movements, the principal terms of the reproductive cycle may be expressed more fully as follows:

- (1) Spring migration of the summer residents to the place of birth;
- (2) Courtship and mating, often with the accompaniment of song;
- (3) Selection of nesting site and construction of the nest;
- (4) Egg-laying;
- (5) Incubation;
- (6) Care of the young in the nest, including feeding, brooding, shielding or "spreading," and cleaning nest and young;
- (7) Care and "education" of young from time of flight;
- (8) Fall migration to winter quarters.

The number of species of birds already described exceeds twelve thousand; they are distributed over the entire globe, and while all conform closely to a single anatomical type their variability, which is expressed in instincts, as well as in color and form, is almost without limit.

The emotional life, and consequently the parental instinct is greater in birds than in any other class of animals excepting the mammals. Their body temperature (100-112° F.) exceeds that of all other animals, and is an index of their great vitality and consequent activity. In the breeding season their emotional behavior reaches its climax. This implies profound seasonal changes in the body, especially in the nervous system, although the precise nature of these changes is not known,—and more obviously in the reproductive cells, the vocal organs, and the plumage. All birds are in full dress at this season, and they all molt immediately after it. In many cases a prenuptial molt further occurs. The succession of molts varies in different species, but it is always of a very definite character. While singing may be exceptionally heard at other times, it is richest in the breeding season; it is always best in the male, and often developed only in that sex.

Birds seem to follow one line of conduct, whether it be building nests, sitting over eggs, or brooding and tending the young, until their instinct in any given direction has been satisfied, thus

normally completing one term of the series before passing to the next in sequence. The machinery, however, rarely works with



Fig. 4. Cedar-bird at nest shown in Figs. 1, 12, and 13, prepared to feed young by regurgitation: a characteristic attitude. The parallel outlines of the neck show that the gullet is full.

absolute precision. Perturbations are sure to arise whenever a contrary impulse comes into the field, and either blocks the path or struggles for supremacy.

Each term of the cycle is capable of analysis into many minor components, differing not only in the sexes, but in different species, and subject to change in different individuals. Thus



Fig. 5. Nesting bough of Kingbird removed from apple tree in background at a point where extended arrows meet, and fixed to upright stakes. Tent-cloth thrown over frame which is set in position.

in feeding the young at the nest, in such a bird as the Robin, there is a complicated routine, involving many different acts—the search after prey and its capture, the approach to the nest which is attended with more or less caution according to

circumstances, the distribution of the food which is again subject to varying conditions, a special call-note being often used when the reaction of a fledgling is slow, the inspection and cleaning of the nest, and the brooding or shielding of the young. Thus not



Fig. 6. Female Kingbird astride nest, protecting young from heat. This and Figs. 7, 36-39, from photographs made at nest shown in Fig. 5.

only do the many subordinate instincts overlap, but their exercise is modified by circumstances. In cool or wet weather a bird will brood her young in order to keep them warm, but on hot days she will stand astride the nest and with spread wings shield them from the heat.

The surge of parental feeling is often marked by an inbred pugnacity, which begins to show itself in certain species at the

very beginning of the breeding season. This fighting mood, which is an adaptation for the protection of the home and all that it contains, is by no means a measure of the other parental impulses. It has a gradual rise, reaches a maximum when the



Fig. 7. Kingbird family. The male with grasshopper in bill,—his mate, partly hidden behind him.

young are ready to leave the nest, at a time when protection is most needed, and then gradually subsides, like a fever which has run its course.

One instinct may be overdone, as when a bird like the Phoebe builds more than one nest, in which case her building instinct is apparently not satisfied by the usual exercise, or another may be scamped, as when Swallows, House Martins, or

Swifts desert their young in order to start on their migrations. When one instinct has been satisfied, wild birds must obey the next in sequence, which seems to possess them with the force of a resistless passion. Some instincts appear to be diffused, or what may be really different emotions lead to similar conduct,



Fig. 8. Female Bluebird with cricket in bill, ready to enter nest-hole.

as when Gulls, which may have dependent chicks, are continually picking up grass and sticks. They will even carry them to a definite spot and settle over them, as if actually intent upon building a nest.

The reproductive cycle is repeated in many wild species, some of which, like Robins and Bluebirds, rear two or three

broods in the same season. The semi-domesticated and gregarious House Sparrow, which often builds lodges or large bag-shaped nests for winter use, is credited with from four to six broods, according to circumstances. The domestic Pigeon, which spends seventeen days in incubation and two weeks in tending its squabs, will sometimes rear upwards of ten broods, while the domesticated fowl in the hands of skillful breeders has been known to produce over 200 eggs (in one case 251 eggs) in a single year.

While the number of eggs to the litter is approximately determinate, the actual number which even some wild birds are capable of producing is surprisingly great, and cases of apparent discontinuous laying have been observed. Thus the Flicker ordinarily lays from four to nine eggs, but by removing one egg at a time and leaving one as a "nest egg," this bird was in one case stimulated to the production of seventy-one eggs in seventy-three days. In most cases the instinct "runs down" before this stage is reached—if the physical powers are not actually exhausted,—and the process is interrupted by fear or some other disturbing factor. A new nest may be built for each litter, when the old is not repaired and made to do service a second time, but, as often happens, no constructive work is undertaken, the eggs being laid in a natural cavity or in the converted nest of some other bird.

In dealing with birds in general, and more particularly with the wilder and more timid individuals, the net balance of their conduct appears to be the result of a series of conflicting instincts, although the disturbing factors may be few in number. Chief among these is fear, which must be constantly reckoned with in the analysis of animal behavior. Again, an important place must be assigned to habit, or associative memory, and possibly to emotions whose character is doubtful. Yet, whenever we attempt to measure animal behavior by rule and have to deal with intelligence, we must expect to meet with individual exceptions at every turn.

When a pair are robbed during the breeding season, or in any way disturbed in mind or property, three courses are open to

them, either to desert and begin operations anew, to stay by the nest and save what is left, or, having done this, to fill up the gap by laying more eggs. The course eventually followed depends upon the nature of the bird, or upon the relative strength of fear, the parental instincts, and habit.

The parental instinct,¹ reënforced by habit, gradually increases until the young are reared. It is therefore safest to change the nesting surroundings when this instinct is approaching its culmination.

The general feeling of fear is gradually or quickly suppressed, according to the value of the different factors in the equation, by the parental instinct, which impels a bird at all hazards to go to its young wherever placed. This impulse, though it be weak at first, is strengthened by exercise, or what amounts to the same thing—by the growth of habits or associations.

After a bird once visits the nest in its new position, it returns again and again, and in proportion as its visits to the old nesting place diminish and finally cease, its approaches to the new position become more frequent, until a new habit has been formed, or, if you will, until the old habit is reinstated.

When the birds approach the nest, any strange objects like the stakes which support the bough, or the tent which is pitched beside it, arouse their sense of fear or suspicion, and they may keep away for a time or advance with caution. If very shy, like most Catbirds, they will sometimes skirmish about the tent for two hours or more before touching the nest. The spell is usually broken, however, in from twenty minutes to an hour, and I have known a Chipping Sparrow and Red-eyed Vireo to feed their young in three minutes after the tent was in place.

At every approach to the nest in its new position, the birds see the same objects which work them no ill. The tent stands

¹ This phrase will be used for the sake of brevity and convenience in nearly the same sense as parental attachment or parental love. As we have seen, there is no *single parental instinct*, but a complex series or chain of instincts belonging to the reproductive period, and subject to marked sexual differences.

silent and motionless, unless it happens to be windy, but the young are close by, and fear of the new objects gradually wears away. Parental instinct, or in this case maternal love, for the instinct to cherish the young is usually stronger in the mother, wins the day. The mother bird comes to the nest and feeds her clamoring brood. The spell is broken; she comes again. The male also approaches, and their visits are thereafter repeated.

Possibly the fears of the old birds are renewed at sight of the window which is now opened in the tent-front, and of the glass eye of the camera gleaming through it, but the lens is also silent and motionless, and soon becomes a familiar object to be finally disregarded. Again there is the fear which the sound of the shutter, a sharp metallic *click*, at first inspires, unless you are the fortunate possessor of an absolutely silent and rapid shutter, an instrument which is unknown to the trade, at least in this country. At its first report when two feet away, many a bird will jump as if shot, give an angry scream, and even fly at the tent as if to exorcise an evil spirit, while after a few hours, or on the second day, they will only wince; finally they will not budge a feather at this or any other often repeated sound, whether from shutter, steam whistle, locomotive, or the human voice. This illustrates the effect of the alarm clock over again. At our first experience with this nerve-wracking machine, we start from deep sleep and promptly heed its summons; then we are apt to mind it less and less until we sleep on serenely in spite of it. If we were to place an alarm clock on or near the nesting bough, and let it off at regular but not too frequent intervals, the birds would soon learn to disregard it as we do, and as some of them disregard the babel of a city street.

It is the young, *the young*, always THE YOUNG, in whom the interest of the old birds is centered, and about whom their lives revolve. They are the strong lure, the talisman, the magnet to which the parent is irresistibly drawn. The tree, the branch, the nest itself, what are these in comparison with the young, for whom alone they exist?

With some species it is possible to make the necessary change without evil consequences when there are eggs in the nest;

with others we must wait until the young are from four to nine days old. It is all a question of the strength of the parental instinct, and this varies between wide limits in different species, and very considerably between different individuals. From the nature of the case there can be no infallible rule. If we know little of the habits of the birds in question, it is safest to wait until the seventh to the ninth day after the young are hatched, or when in many passerine

**When to
change the
Nesting Site**



Fig. 9. Outdoor Observatory for the Study of Wild Birds—complete, showing the observation tent, the nesting trunk (in this case belonging to the House Wren) mounted on a pivot and surrounded by the protective wire net, with white photographic screen at back. The running series of Wren pictures (Figs. 16-30) were made at this nest, Northfield, N. H., July, 1901.

birds, as Robins, Orioles, and Waxwings, the feather-shafts of the wing-quills begin to appear in the young, or, better, when they project from one quarter to one half inch beyond the feather-tubes. At this period the parental instinct is reaching its maximum, and, what is equally important, the sense of fear has not appeared in the young.

When we try to formulate a rule, however, we at once encounter numerous exceptions. Thus in Cuckoos the feathers

do not shed their envelopes gradually as in most birds, but remain sheathed up to the last day in the nest. Of greater importance is the understanding of the principles involved, and with these in mind and judiciously applied very few mistakes should be made.

At the beginning of observations a nest with eggs should be watched, but not disturbed. When the period of incubation has been determined, and the time of hatching known, the young may be examined and photographed if it is desired. At all events, they should be watched until the critical time arises for closer study. This decided upon in the manner already suggested, circumstances must determine the course to be followed.

Mode of Procedure

If the nest, like that of a Robin or Kingbird, is saddled to the branch of a tree, saw off the whole limb and nail it to stakes driven into the ground, so placed as always to give the best light. The nesting bough, in case there is one, should be set with its long axis parallel with the course of the sun, but the position of the bough or tent may be changed during the day when exceptional conditions render it necessary.

Either a dark foliage or a sky background may be chosen for the nest, according to the desire of the operator or the possibilities of the situation. In the first edition of this work it was suggested that whenever a suitable natural background could not be obtained, it would be possible to place either light or dark screens behind the nesting bough, but that no experiments in this direction had then been made. I have since adopted a white photographic screen, and often find it a most useful adjunct to the outdoor observatory. The birds pay little heed to it, except to find in it a useful perch and vantage point for their own observations. The tent is then to be placed in position, or it may be pitched and left overnight beside the nest.¹ In other words, operations may begin at once or be postponed until the following day, the better plan for a beginner until he has mastered minor difficulties, which, though small in

¹ Directions for the construction and use of tent and screen are given in Chapter III.

themselves, are far from unimportant. When the tent is closed absolute silence must be maintained, for while this is not always necessary it is the best rule to follow during the first days of observation.

The best time to begin is from eight to nine o'clock in the morning, because the young will then have been fed, and the sun will be getting high enough for the most rapid photographic work. One may spend as many hours a day, and as many days at one nest, as time permits or inclination decides. I will only suggest that the second day is always better than the first, and that the third or fourth is always sure to bring something new. If one would learn the nesting habits of any species thoroughly, it will hardly do to rely upon one nest. The more you see of different nests and different birds the better.

I usually spend five or six hours in the tent, from nine in the morning until three in the afternoon, when the weather is fine. If the camping ground is near my house, as it often is, I leave the tent for half an hour at noon, but if it is far, I carry a lunch and spend the day. When possible, I am always on hand during the last day of life at the nest, to see the young leave it, usually one at a time, and to witness the manoeuvres of the parents in conducting them to the nearest trees.

Under some circumstances, as when studying Gulls and other sea fowl, I have found it distinctly advantageous to use two tents, occupying one in the morning and the other in the afternoon, or setting the second tent one or two days in advance, so that when required it will have become a familiar object to the birds, and no time need be lost.

Young birds from one to five days old cannot, as a rule, stand excessive heat. Even when fed and brooded they will sometimes succumb, and here lies the serious danger to be guarded against. A nest of very young birds well shaded by foliage cannot be safely carried into the direct sunshine of a hot summer's day, hence the importance of beginning operations at the proper time when the weather is suitable, and, further, of not allowing your enthusiasm to get the better of your judgment.

Precau-
tions to be
observed

The morning of a clear, mild day is preferable, but since we cannot order the weather it is better to leave the birds to themselves if it promises to be excessively hot or windy.



Fig. 10. Female Chestnut-sided Warbler shielding the young on a warm day
Photographed from tent shown in Figs. 2 and 3.

The young may be fed or handled as much as one wishes, provided the instinct of fear has not developed. If you are uncertain as to this and your aim is to study the nesting habits,

it is better to avoid approaching, touching, or in any way disturbing the young after the flight feathers have appeared. The cutting of leaves or twigs which obstruct the light or cast undesirable shadows should be done before this time.

On the other hand, investigations of the young which require accurate weighing, measurements, or photographs of the birds themselves, place the matter in a different light. With these objects in view the nest must be frequently approached and the young taken out, and for such studies the change of the nesting site offers such obvious advantages that it is needless to dwell upon them. In taking down the nesting bough it is often necessary to touch the nest, but this does no harm.

Young birds eight or nine days old stand the heat well, provided they are fed, but on very hot days they should not be allowed to go without food for more than two hours at the longest. Should the parents bring no food during this time, it is better to feed the young in the nest, or to return the nest to its original site, and suspend operations until the next day.

Sudden storms of wind and rain or equally severe blasts of torrid heat are liable to arise on any summer's day in the country, but their evil effects can be greatly mitigated, if not overcome, by careful watching. Special care should always be taken not to cut away too much foliage around a nest of very young birds. As already suggested, one should follow the rule of leaving the birds to their own devices in days of unusual heat or humidity.

As has been already said, the old birds may be expected to come to the nest in from twenty minutes to an hour, when the tent is brought into immediate use after removal of the nesting bough. It is naturally impossible to predict exactly what will happen in any given case until the experiment is tried, since the personal equation or individuality of the birds themselves is an unknown and variable factor. One thing only is certain, that the parental instincts, reënforced by habit, will win in the end, that they will cast out fear, and draw the birds to their young. If proper precautions are taken, everything should go well, and the young leave their nest in due course.

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When the first edition of this work was published in 1901, I had used the tent, with or without changing the nesting site, in the case of twenty-six nests, belonging to fifteen species of birds; the list is now extended to embrace fifty-nine nests, belonging to thirty species, and the experiments, which have been continued through five successive seasons (1899-1903), may be regarded as fairly establishing the value of the method. That the extent of its application is wide is equally clear.¹ In the entire list, which is now tabulated for the benefit of future workers, the age of the young is in most cases estimated from the data at hand, which are only approximately accurate.

EXPERIMENTS IN THE USE OF OBSERVATION TENT AND IN THE CHANGE OF NESTING SITE.

BIRDS AND NESTS.	TIME.	NUMBER OF YOUNG.	AGE OF YOUNG.
1 Redwing Blackbird (Nest undisturbed).....	July 14, 1899	3	11 days.
2 Redwing Blackbird (Nest swayed down one foot).....	July 19, 1900	3	5 days.
3 Catbird (Nest undisturbed)...	July 23, 1899	2	8 days.
4 Catbird (Position of nest unchanged).....	July 26, 1899	3	3-4 days.
5 Catbird (Nesting bough displaced ten feet).....	Aug. 4, 1899	3	7-8 days.
6 Catbird (Nest undisturbed)...	June 21, 1900	4	7 days.
7 Cedar-bird (Nesting bush moved twenty feet).....	Aug. 3, 1899	4	9-10 days
8 Cedar-bird (Nesting bough displaced forty feet).....	Aug. 21, 1899	4	6 days.

¹ Mr. John B. Parker, of Cleveland, Ohio, has further successfully applied the method to ten additional species, including the Field, Vesper, and Grasshopper Sparrows, the Acadian Flycatcher and Wood Pewee, the Goldfinch, Cardinal Bird, Yellow-billed Cuckoo, and the Cooper's Hawk, a bird of an exceedingly shy and suspicious nature.

Mr. Ned Dearborn, of the Field Columbian Museum, Chicago, has also used the method with valuable results. (See *Birds in their Relation to Man*, by Clarence M. Weed and Ned Dearborn; the J. B. Lippincott Co., 1903.)

BIRDS AND NESTS.	TIME.	NUMBER OF YOUNG.	AGE OF YOUNG.
9 Cedar-bird (Nesting bough cut off and moved fifty feet)	Aug. 23, 1899	2	10 days
10 Cedar-bird (Nest in pine tree; bough moved fifty feet)....	July 14, 1900	4	7-8 days.
11 Cedar-bird (Nest in apple tree fourteen feet up; branch moved twenty feet).....	July 6, 1901	4	9 days.
12 Cedar-bird (Nest built of bright-colored yarn in apple tree, fifteen feet from ground; moved thirty feet to point opposite porch, where it was constantly in view).....	July 9, 1901	5	5 days.
13 Red-eyed Vireo (Nesting twig lowered one foot).....	Aug. 3, 1899	2	8 days.
14 Red-eyed Vireo (Nesting tree cut down and taken from woods forty feet to open)...	July 5, 1900	4	9 days.
15 Red-eyed Vireo (Nest in maple ten feet up; tent pitched on staging beside undisturbed nest).....	July 2, 1902	3	5-6 days.
16 Warbling Vireo (In apple tree seven feet from ground; moved to an adjoining field near house one hundred and sixty feet).....	June 23, 1902	3	9 days.
17 Robin (Nesting bough cut off and moved thirty feet)...	Aug. 9, 1899	3	7 days.
18 Robin (Nest in oak thirty feet up; branch moved to open field sixty feet away).....	July 25, 1900	3	6 days.
19 Robin (Nest in pine fifteen feet up; branch removed twenty-five feet).....	June 13, 1901	3	7 days.
20 Robin (Nest in apple tree twenty feet from ground; moved one hundred feet)...	July 11, 1901	3	6 days.
21 Bluebird (Nest-hole in apple tree; moved fifty feet to open field).....	Aug. 15, 1899	4	5 days.
22 Bluebird (Cavity in dead apple-branch twelve feet up; whole moved twenty feet).....	Aug. 5, 1901	5	7 days.
23 Chestnut-sided Warbler (Bushes cleared in front of nest).....	June 15, 1900	4 eggs	—

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BIRDS AND NESTS.	TIME.	NUMBER OF YOUNG.	AGE OF YOUNG.
24 Chestnut-sided Warbler (Bushes cleared in front of nest).....	June 28, 1900	4	4 days.
25 Night Hawk (Nesting site with young enclosed with wattled twigs).....	June 29, 1900	1	5 days.
26 Baltimore Oriole (Nesting branch in apple tree; moved twenty-five feet).....	June 25, 1900	3	8-9 days.
27 Baltimore Oriole (Nest in elm fifty feet from ground; moved with limb weighing several hundred pounds)...	June 25, 1901	3	10 days.
28 Kingbird (Nesting branch moved twenty feet).....	July 2, 1900	2	6 days.
29 Kingbird (Nesting branch moved twenty-five feet)...	July 2, 1900	4	7 days.
30 Kingbird (Apple tree fifteen feet; moved forty feet)....	July 23, 1901	3	8 days.
31 Wilson's Thrush (Nest in tus- sock; whole moved from swamp to open fifty feet)...	July 9, 1900	3	10 days.
32 Chipping Sparrow (Nesting bough moved twenty feet)...	July 11, 1900	4	4-5 days.
33 Chipping Sparrow and Cow- bird (In apple tree twenty feet; removed sixty feet)...	July 23, 1901	1	8 days.
34 Brown Thrush (Nest in thorn bush; moved fifteen feet)...	July 11, 1900	3	4 days.
35 Song Sparrow (Nest in dead sapling; moved forty feet to open).....	July 17, 1900	3	5 days.
36 Kingfisher (Nest in bank; opened at rear).....	July 23, 1900	5	9 days.
37 White-bellied Swallow (Nest box lowered to height of four feet).....	July 11, 1901	4	10 days.
38 Sand Martin (Nest undis- turbed).....	June 21, 1901	—	—
39 Chebec (Nest in apple tree fifteen feet from ground; nesting branch moved thirty feet).....	June 29, 1901	4	8-9 days.
40 Chebec (Nest in pine eighteen feet from ground; branch displaced twelve feet)....	June 10, 1902	3	9 days.
41 Chickadee (Nest in stub five feet high; moved twenty feet).....	June 12, 1901	6	10 days.

BIRDS AND NESTS.	TIME.	NUMBER OF YOUNG.	AGE OF YOUNG.
42 Chickadee (Converted Woodpecker's hole in stub four feet tall).....	July 22, 1901	—	—
43 Rose-breasted Grosbeak (Nest in thorn-apple twelve feet up; moved forty feet).....	June 13, 1901	4	7 days.
44 Towhee Bunting (Ground-nest with young enclosed by twig-fence).....	June 21, 1901	4	10 days.
45 House Wren (In abandoned nest-hole of Woodpecker eight feet up; moved twenty five feet).....	July 18, 1901	—	—
46 House Wren (Nest, abandoned hole of Chickadee in dead apple-limb twelve feet from ground; removed thirty feet).....	Aug. 13, 1901	4	7 days.
47 House Wren (Nest in horizontal prong of apple tree five feet from ground; moved 760 feet to a point where its original site was completely hidden by an intervening house and orchard).....	Aug. 26, 1901	3	12-13 days
48 Red-breasted Nuthatch (In dead branch of apple tree ten feet from ground; removed thirty feet).....	June 7, 1902	—	10-11 days
49 Spotted Sandpiper (Ground-nest undisturbed).....	June 4, 1902	4 eggs	—
50 Flicker (Nest-hole drilled in dead trunk of apple tree; moved fifteen feet, set up on pivot in field, and screened with wire netting; large white photographic screen placed at back).....	June 16, 1902	6	5 days.
51 Crow (Nest seven feet from apex of sapling pine twenty feet from ground; ten feet of tree holding nest cut off, set up thirty feet away, and protected with wire screen).	June 4, 1902	4	Nearly full-fledged.
52 Arctic or Common (?) Tern (Matinicus Rock, Maine; rock-nest undisturbed).....	July 12, 1902	2 eggs	—

BIRDS AND NESTS.	TIME.	NUMBER OF YOUNG.	AGE OF YOUNG.
53 Wilson's Tern (Weepeeket Islands, Buzzard's Bay, Massachusetts; ground-nest undisturbed).....	Aug. 1, 1904	3 eggs	—
54 Great Herring Gull (No-Man's-Land Island, Maine; rock-nest undisturbed).....	July 14, 1902	2 young and 1 "pipped" egg	1-2 days.
55 Great Herring Gull (Great Duck Island, Maine; ground-nest undisturbed).....	July 18, 1902	2 eggs, 1 "pipped"	—
56 Great Herring Gull (Great Duck Island, Maine; rock-nest).....	July 21, 1902	3 eggs	—
57 Great Herring Gull (Great Duck Island, Maine; ground-nest).....	July 6, 1903	3 eggs	—
58 Great Herring Gull (Great Duck Island, Maine; family on "preserve").....	July 7, 1903	3 chicks	3-4 weeks.
59 Great Herring Gull (Great Duck Island, Maine; ground-nest).....	July 7, 1903	3 eggs	—

In only four or five cases when the nest with its supports has been displaced (Nos. 8, 20, 21, 35) have the young come to grief, in the course of five years' work. In addition, a young Cowbird was, as I supposed, stolen by a cat. These accidents were due, moreover, in all but possibly two cases, to preventable causes. A nest of Cedar Waxwings, though fed by both birds and shielded almost constantly, were overcome by the heat and humidity. Some Bluebirds and Robins, both of which fed their young, were interfered with by hay-makers and workers in the field. A brood of Song Sparrows also succumbed to the heat on a day which the Weather Bureau in New England reported as the hottest ever recorded. In addition to this, their nest, which was moved to the open, happened to be placed in the crotch of a dead sapling, so that the birds were exposed on all

sides. There was doubt in the case of a nest of House Wrens (No. 45), the young of which were not seen. They became so



Fig. 11. Red-breasted Nuthatch carrying insect to nest in dead trunk of apple tree. The bird has the singular practice of smearing the entrance with drops of pitch, some of which are seen just above the opening. This Nuthatch always entered right foot first.

tame that they would come boldly within reach of the hand, and if their young were destroyed the culprit must have been a squirrel or a weasel.

Kingbirds have remained in the nest eleven days after the change, Robins a week, Cedar-birds six days. A glance at the table will show that in the case of the Chestnut-sided Warbler (23), the Spotted Sandpiper (49), and a number of Gulls and Terns, observations were begun when there were eggs, and no doubt there are many species or individuals in which it would be possible to watch from the tent the whole family-life, from hatching to flight from the nest, but only careful and experi-

enced students should experiment in this direction. It all depends on the strength of the parental instincts at the period in question. As was said in a former edition, where the attachment to nest and eggs is strong, as in Owls, Fish Hawks, Flickers, Kingbirds, and the Chipping Sparrows, to mention a few cases, we might look for success, but the subject does not admit of this simple analysis. Setting aside individual variation which confronts us at every turn, we must remember that what we call for convenience *parental instinct*, as has been explained, is a complex of instincts, embracing many distinct kinds of activities, such as nest-building, egg-laying, incubation, brooding, feeding, and care of the young, in the course of which fear is a variable factor. Thus, the sense of fear is completely blocked in the Flicker by the brooding instinct; when possessed of this impulse you may knock loud and long at her door, saw open her house, and even take her in the hand, but she will not budge a feather; yet a few days later, after the young need this attention less, the same bird becomes very shy. The persistency of the sitting hen is proverbial, and in attempting to thwart her plans the beautiful precision of her instinct, which is apt to be regarded as an index of total depravity, is not sufficiently appreciated.

Having early expressed my confidence in the future of the movable tent as an observatory for the study of nesting birds, I am pleased to find that many field-ornithologists have adopted it with success in various parts of the country. As a blind for watching the scenes at the nest it fulfils every requirement, and all questions of accessories, or even of color, for the purpose of concealment, are of minor importance, as students of animal behavior will soon learn. The tent may prove serviceable in watching the building of the nest, in such species or individuals as have a strong attachment to chosen sites, and whose plans are not easily disturbed by trifles; in many cases, however, no blind is needed, perfect quiet being the only requisite. If experiments in this direction are made, care should be taken not to place the tent too near, at least on the first day. No doubt many kinds of birds may be attracted by food and other

lures to the tent, which soon commands no more attention from them than a rock in the landscape, but the possible rewards of sedentary experiments in this direction are too uncertain to arouse much enthusiasm in the mind of the active bird student.

This method of studying the daily life of wild birds is recommended chiefly to those careful students who are making a study of the habits and instincts of animals, and who are prepared to devote much time and energy in the field. The indiscriminate use of any method of studying the home-life of birds is fraught with danger to the young, and to displace a nest at the wrong time in order to photograph it, or to leave it unprotected, may often open wide the door of destruction. When the study of birds with the camera is pursued as a recreation, the rule should be to disturb the nest and its occupants as little as possible.

Since an account of the method was first published, the chief objections which have been raised against it are: (1) that the displacement of the nest is liable to expose the young to new dangers, especially when it is removed from a place of concealment to a conspicuous point in a field, and (2) that the inexperienced, ambitious to use their cameras, would be tempted to move a nest, without serious intent, and thus invite that destruction to our birds, which is already far too great, and which every lover of nature should do his utmost to prevent.

Under the first head would fall the liability of the parents to desert, exposure of the young to heat, cold, storms, and above all to that inveterate enemy of the nestling bird—the remorseless cat. Enough has already been said about the weather, which in all protected nests does not enter into the question, and in all exposed ones must be guarded against in the ways suggested. The nesting bough, when firmly fixed to supports, is more secure than it could have possibly been before. The designs of the cat may be completely frustrated by the wire-screen, or when the branch or trunk holding the nest (as in the case of a Woodpecker or Bluebird) is mounted on a pivot, by a simple device to be later described. In referring to this subject in the earlier edition it was said that predacious animals of all kinds seemed

to avoid the displaced nest as if it were a new means to entrap and slay them. It is best, however, not to stake too much upon this assurance, for no nest of young birds is ever safe, however perfectly concealed. We must also be aware that cats and all wild depredators, like the birds themselves, soon become accustomed to new objects and surroundings. Whenever it is possible, the displaced nest, or indeed any ground-nest which is not disturbed, should be protected by a wire net, which can be easily constructed so that it will stop both feline and rodent, and even the snake. It is impossible to overestimate the importance of this screen, especially in a country overrun by cats.

The only depredator of whom I stand in fear is the irresponsible or malicious small boy, and to anticipate his possibilities for evil it is best to take a look at the nest now and then when not encamped beside it.

The possible failure of parental instinct and consequent desertion of the young is the most important objection with which we have to deal. While it is impossible to predict what individual variation may sometimes effect, experience has now amply proved that in the large number of cases already dealt with (see table of experiments) this seldom or never happens at the height of the breeding season, provided the precautions already suggested are taken. To ensure success, the parental instincts must be approaching their climax, and not on the wane. The remarkable fact, not unknown to breeders of domestic Pigeons, has already been noticed, that certain birds will occasionally desert their young, when passing under the sway of a new impulse. While the attunement of the instincts must be fairly perfect for the average individual, whether adult or young, exceptions abound, and are of course liable to be encountered at any moment in the field. The best answer to this question, however, is given by the record of actual experiments (see table and comment).

The second objection, which refers to the possible harm done by the young or inexperienced observer, need give us little concern, for novelty soon wears away and the practice requires a far greater expenditure of patience, energy, and time than an

amateur would willingly give. I would not vaunt the patience of the naturalist, who is accustomed to work in the field or laboratory for weeks or months to attain his desired ends, and



Fig. 12. Cedar-bird's nest—No. 10 of table—in original position marked by arrows. See Figs. 4 and 13.

those ends he will attain provided they can be compassed by intelligence, industry, and skill, for patience is the stock in most successful trades, but, while success may never come because of it alone, none can be assured without it.

In the ten days or two weeks or more of life at the nest events move rapidly and the question of time is important.

Any interruptions are therefore opportunities for the display of patience rather than for the increase of knowledge.

We have already seen that the displacement of the nest or nesting branch does not introduce unnatural conditions of any



Fig. 13. Cedar-bird's nest in its new site. Nesting bough moved fifty feet to open field. Compare Figs. 1, 4, and 12.

importance into the life of the birds. Of course every change wrought by man is in a certain sense unnatural. If we pluck a single leaf from a tree, that tree is no longer in its natural state, but the change counts for nothing. If we keep on plucking leaves, however, a time will come when the arm of the balance is disturbed, and the denuded tree is sure to suffer. The removal of a leaf or twig about a nest is of no practical consequence, but this should not be carried too far, both on account of

the young which need the protection of shade, and for the sake of natural appearances which we wish to preserve.

It might be supposed that when a branch is lopped off, its foliage would at once wither, and unduly expose the nest or detract from the artistic value of a picture. The fact is, however, that there is commonly enough sap in a hard wood bough of moderate size to keep the leaves fresh for several days, and towards the close of life at the nest the young need no protection from this source. As to this point, however, the illustrations in this book will speak for themselves. When the nesting branch is vertical and not too large, it can usually be kept fresh for a sufficient time by setting it in a can of water, which should be sunk in the ground.

Evergreens like the pine and spruce hold their leaves bright for a long time after cutting, and in this respect the various deciduous trees and shrubs differ greatly, those with a hard, close grain keeping fresh the longer.

As to any injury to trees which the method may be supposed to entail, it is not worth considering, since no valuable tree should be mutilated without first obtaining the permission of the owner, for however trifling the damage may appear, his point of view is likely to be different from your own. The cutting of an occasional twig or branch, even if it does not trim the tree, is not regarded as an important event in this country at present. If every farmer who owns orchards and woodlands did his duty, he would cut out more useless wood in a year than a student of birds would need to do in a decade. It should be unnecessary to add that no one should set up a nest in a field, and leave the trouble of removing it to the owner of the land.

When the nest is completely exposed and the weather is very hot, the young may be tempted to forsake it a day or two earlier than they would naturally do, but this does not usually happen and is not necessarily serious. Some Kingbirds, already referred to, spent eighteen days in the nest, and were a week old when it was moved. This was probably longer than common, and certainly longer than necessary.

The tent not only conceals the observer but protects his

camera, an important consideration, since the prolonged action of the sun is liable to spring a leak in the bellows. As to the portability and general convenience of the tent I shall speak elsewhere.

With notebook in hand you can sit in your tent, and see and record everything which transpires at the nest, the mode of approach, the kind of food brought, the varied activities of the old and young, the visits of intruders, and their combats with the owners of the nest, the capture of prey which sometimes goes on under your eye. No better position could be chosen for hearing the songs, responsive calls, and alarm notes of the birds. You can thus gather materials for an exact and minute history of life at the nest, and of the behavior of birds during this important period. More than this, you can photograph the birds at will, under the most perfect conditions, recording what no naturalist has ever seen, and what no artist could ever hope to portray. The birds come and go close to your eye, but unconscious of being observed.

**Advantages
of the
Method**

I have watched the Night Hawk feed her chick with fireflies barely fifteen inches from my hand, the Kingfisher carrying live fish to its brood whose muffled rattles issued from their subterranean gallery a few feet away. When near enough to count her respirations accurately, I have seen the Redwing Blackbird leave her nest on a hot day, hop down to the cool water of the swamp, and after taking a sip, bathe in full view, within reach of the hand; then, shaking the water from her plumage, she would return refreshed to the nest. I have seen the male Kingbird come to his nesting bough with feathers drenched from his midday bath in the river, the Orioles flash their brilliant colors all day long before the eye, and Chestnut-sided Warblers become so tame after several days that the female would allow you to approach and stroke her back with the hand. Again, when camping on an island by the shore, I have seen the Tern, on coming to her nest, an egg of which had exploded during her absence, the heat of the midday sun being more than it could stand, bend over, insert her lower mandible in the blow-hole, and, gradually lifting the heavy egg in her bill, bear it slowly

to the sea and drop it in the water. Upon her return, she gathered up every fragment which might defile the nest and bore it away.

When encamped on a rock-bound shore, above the surge of the waves, I have watched hour by hour and day after day the



Fig. 14. Family of Great Herring Gulls on their "preserve," with one chick a day old and two eggs. The male at the right has just dropped from the perch on the log above; the brooding mother immediately rose from the nest and is seen sounding the scream of defiance, which is evidently not a danger signal. The male then summoned the chick to the feeding spot, which is at the side of the nest, and his mate retired to the perch.

comic and the tragic scenes in which the nurseries of the Great Herring Gull abound, and from such vantage points have been able to follow in every detail that remarkable polity which has grown out of the communal life of these splendid sea fowl.

It is difficult to describe the fascination which this method of study affords the student of animal life. New discoveries or unexpected sights wait on the minutes, for while there is a

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well-ordered routine in the actions of many birds the most charming pictures occur at odd moments, and there is an endless variety of detail. It is like a succession of scenes in a drama, only this is real life, not an imitation, and there is no need of introducing tragedy. From the tent one may read the life of the nesting bird as out of an open book.



CHAPTER II

ILLUSTRATIONS OF THE METHOD

IT is always interesting to see how birds actually behave when put to the test, and as illustrations of the method applied I have selected four common birds, the Cedar Waxwing, the Wren, the Redwing Blackbird, and the Kingbird. The choice might have fallen, however, upon any others in my list, for the principles are in every case the same.

For the present we are chiefly concerned with the change of nesting sites and with the behavior of these birds in the face of new surroundings.

On the third day of July a Cedar-bird's nest (No. 10 of table on page 22) was discovered in an unusually attractive situation.

The Cedar-
bird It was fastened to the horizontal branch of a white pine about fifteen feet up, in the line of an old stone wall that bounded an open field. In passing beneath the tree almost daily during the following week, I was sure to find one of the old birds, the female as I supposed, always on the nest and sitting in the same alert attitude, engaged either in incubation or brooding. With upstretched neck she would sit motionless and silent as a statue, as if listening intently, her dark eye shining like a jet black bead against the background of pine needles. I was waiting for the propitious time to move this nest to the open field. This time arrived on July 14th, when the heads of the young began to appear over the rim of their nest. The bough was then sawn off, carried fifty feet from the tree, and set up in the newly mown field, in an east to west line at a height of four feet from the ground, and in such a way that the birds could be "skyed," and the light would be good from nine o'clock in the morning until three in the afternoon.

The tent was then pitched and closed; the whole operation lasted longer than usual owing to some difficulty in getting stakes of the right height. Fifteen minutes is usually long enough for this work.



Fig. 15. Cedar Waxwing standing at inspection: a characteristic pose. Compare Figs. 1 and 4.

From peep-holes the old birds could be seen in the nesting tree, and you began to hear their faint *z-e-e-e-e-t!* in response to calls from the young. In twenty-four minutes the female was on the bough and fed her brood with red bird cherries by regurgitation. At this point I was obliged to leave the tent and ask some curious boys to keep away, but the mother bird was back in a moment. In a short time the old birds began to alight on the peak of the tent, which was an observatory for them as

well as for the person inside. Taking a look about, they would drop down to the nest only a step away. This was done more than ten times in the course of the day. Observations began at 8.40 in the morning and closed at 4.40 P. M., so that, with an intermission at noon, they lasted nearly seven hours and twenty minutes. During this interval the young were fed with wild red cherries, blueberries, and insects,—mainly grasshoppers, and nearly always by regurgitation. The nest and young were regularly cleaned, and the new conditions seemed to have been completely adopted. The young, whose wing-quills now showed half an inch of the feather shaft, were entirely fearless.

On July 16th, the second day of observation and the third after the removal of the nesting bough, the old birds began the work of feeding in exactly twelve minutes after the tent was in place. I will add here that I have usually removed the tent at the end of the day's work, although in some cases it has been found advantageous to leave it overnight. In a little more than three hours the old birds came to the nest eighteen times, bringing abundant stores of fruit and insects.

On July 17th, the third day at this nest, feeding began in three minutes after closure of the tent. It was the hottest day of the summer, but life at the nest went on without accident or interruption. The young now sat or stood with heads upturned in the characteristic attitude shown in one of the illustrations. They flew on the morning of the 19th of July, when thirteen days old, seeking the cover of a thicket of birches close by, where they were cared for by their parents until ready to leave the neighborhood. They were scattered over an area of several square rods, and kept calling in their monotonous way, *z-e-e-e-e-t!* *z-e-e-e-e-t!* One of their number, shown in a photograph (Fig. 59), was not touched or posed, but occupied a natural perch chosen by himself in his flight from tree to tree.

About the middle of July I noticed the neatly drilled circular opening of a Chickadee's nest on the underside of a small dead apple branch, about twelve feet from the ground. It was so admirably adapted for study that I remember the feeling of regret at being so late in the field.

The House
Wren

I determined, however, to save the nest; but, upon coming to take it down, on the 24th of July, discovered that it was occupied, after all, and by a family of House Wrens. After the Chickadees had moved out, the Wrens had evidently moved in. The Wren is a close sitter, and when incubation is well advanced it is difficult to drive the female from her eggs. In the present case nothing short of a violent shaking of the whole tree would suffice. Finally a sleek little bird would appear at the window, showing a sharp bill and clean-cut profile, and in a moment go off scolding, or giving its harsh rattle, which is really a signal of alarm—*ek-ek-ek-ek-ek-ek-ek-ek!* Then, with tail cocked and with rapid, jerky movements, it would hop along the fence or over the branches of a tree, turning on its shrill rattle every few seconds, until confidence was restored. The Wren's tail, though a very sensitive register of emotion, is not invariably cocked, as might be inferred from the picture-books.

When it seemed likely that the little Wrens were a week old, I cut off the dead branch below the opening, carefully lowered it to the ground, and mounted it on a pivot in the field. The stump was then surrounded by a protective wire screen of ample height (see page 63), and the tent was set up on the morning of the following day, August 24th, at twenty minutes after nine o'clock. In order to secure a clear background, a white photographic screen (see p. 62) was later placed behind the stump, and our outdoor observatory was complete (Fig. 9). By its means the home life of old and young could be studied and registered with a precision hitherto unknown. Though the birds would now come and go within reach of the hand, they were quite unaware of being observed.

I watched this Wren family during parts of five days, and altogether for eleven hours and five minutes. On the fourth day the stump was sawn open, so as to expose the young, which were then well feathered and able to crawl to the opening. The illustrations of the scenes at this nest were selected from a series of nearly one hundred photographs, which represent a complete pictorial analysis of the behavior of this bird.

In just a minute after entering the tent on the first day,



Figs. 16-19. House Wrens climbing to nest-hole with food. For description see List of Illustrations.

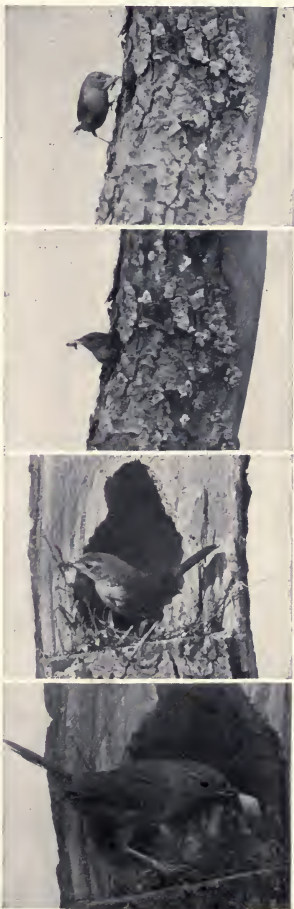
Mother Wren was on the stump and sounding her alarm, *ek-ek-ek-ek-ek-ek-ek-ek-ek!* In giving this harsh rattle the bill does not close, but the lower mandible moves rapidly and the whole body quivers, as the air is expelled in little puffs from the throat. A few minutes later she was crawling up the bark like a mouse, with a field-spider pinched between the sharp points of her bill. Her next victim was a black beetle, but, frightened at some object or sound, she brought it to the stump many times, reeling off her harsh rattle, or giving her incisive *kek! kek!* before venturing inside.

The work of feeding was borne wholly by the female, both at this and at another nest studied earlier in the season. She would come and go quietly, unless disturbed, when her rattle would sound until every suspicion was allayed. Sometimes she would fly first to the tent roof, then to the stump, running up or down to the hole. Again she would alight on the screen, and then go to the stump by way of the wire net, always pausing at the entrance to the nest before venturing inside. It was some

time before a definite course of approach was adopted, and this was necessarily modified whenever the stump was rotated to improve the light. The young chirped briskly as the mother approached, and, like the young of other birds, were keenly alive to every sound. After inspecting and cleaning the nest, she would return to the entrance, often with the excreta in her bill, survey the field for a moment, and be off.

This bird had the peculiar habit of tearing the legs and wings from large grasshoppers and moths before bringing them to the nest. The photographs demonstrate this clearly. The effect of such rough treatment was certainly to prevent the escape of the prey. I was surprised to find that small spiders were also subjected to a similar ordeal, only their plump, spherical abdomens, which I at first mistook for egg-cocoons, being served to the young (Fig. 16).

I once drove this bird away with my hand four times in rapid succession, until the insect which was finally delivered could be observed and a photograph obtained. This was a good illustration of the force



Figs. 20-23. House Wrens, entering, leaving, and cleaning nest.



Figs. 24-27. Attitudes of the House Wren exhibited on stage over nest; the trunk is sawn open.

of habit, and a good index of the degree of familiarity already attained.

On the second day a high wind shook the tent, and the screen flapped like the sail of a vessel at sea, but life at the nest went forward without a break. Even when the wind tore up the screen and carried it with a crash against a neighboring fence, the bird hardly noticed it, and two minutes later came bringing to its young a large moth, minus wings.

In order to expose the nest itself, the stump was sawn open on the fourth day, but the routine of nest life was interrupted for only seven minutes. A convenient platform, or stage, was thus made just above the nest, and upon this many lively scenes were enacted in the course of the day. A series of pictures (Figs. 16-30) shows many attitudes of this little Wren, as she strode up or down to the nest-opening, as well as the variety of insects carried, and the treatment which many of them had received.

I once photographed this bird as she stood on the stage over the nest with a large grasshopper in her mouth, and her behavior suggested some con-

nection between bulb and bill, for at the click of the shutter she promptly swallowed the insect and was off.

The Wrens have a peculiar way of disposing of the excreta. The sac is taken direct from the body of the young and carried to a tree, where it is deposited or impaled on the bark of a limb. The sac is rarely, if ever, eaten, and never allowed to fall to the ground.

During the whole period of observation, which lasted eleven hours and five minutes, the young were fed one hundred and one times, at an average rate of once in six and a half minutes (on the first day once in two and a half minutes), and the nest was inspected and cleaned twenty-eight times. The bill of fare, as far as recorded, consisted of nine different articles, served in respect to abundance in the order named as follows: grasshoppers, thirty-three times; spiders, twenty-five; moths, fourteen; black crickets, six; green larvæ, two; brown larvæ, two; besides field cricket, green katydid, and black beetle, each served once.

During the last day of study at this nest the young crawled to the opening and took their



Figs. 28-30. Descending to nest.
Fig. 31. Young Wren leaving nest.

first flight, landing in the grass not many feet away. They would run like mice, and their brown protective coloring, exactly like



Fig. 32. Tent over raft in water of swamp beside Redwing Blackbird's nest. See Figs. 33 and 34, No. 2 of table.

that of the old birds, made it no easy matter to recover them when once at liberty.

On the fifth day of July a nest of three young Blackbirds (No. 2 of the table), aged five days, was found on the edge of what was once an alder swamp, close to the town and the "Cove" made by the Winnipiseogee River in Northfield. It was fixed

to several slender stems of *Spiræa*, amid a dense tangle of *Cephalanthus*, wild roses, and purple milkweeds. The situation was so attractive and offered such fine opportunities for studying these birds that, notwithstanding the water and mud, I determined to make careful preparations. A space four feet square was at once cleared of bushes at one side of the nest. In order to sky the

The Red-
wing
Blackbird



Fig. 33. Male Redwing Blackbird feeding young.

birds, the nesting twigs were slightly raised, but none of these were severed or otherwise displaced.

On the ninth of July I built a raft or platform on the cleared area, and painted it green, which was soon found to be an unnecessary precaution. When weighted with the observer and

his apparatus, the flooring was barely clear of the water. On the following day, the tent was pitched over this stranded raft and guyed to the bushes, the tent poles having been previously lengthened to suit the depth of mud and water. Everything was ready for observations at half-past nine o'clock. At first the birds fluttered around the nest *chucking* and whistling in-



Fig. 34. Female Redwing Blackbird with feathers erect, keeping cool while shielding young from heat.

cessantly, but in less than an hour the warble of the male was heard, which is a sure sign of growing confidence. Then both birds went off for food, returned, reconnoitred the tent and nest, and after precisely one hour and twenty-three minutes from the beginning of observations the female came and fed her

clamoring young. Again she was off and back three times in rapid succession. Three minutes later she was brooding, and remained on the nest thirteen minutes. Leaving it again, she examined the tent anew, then brooded ten minutes more. A little later the young were fed and the nest cleaned with great care.

The male was more cautious and did not actually feed his young until twenty-seven minutes after eleven. His fears were then dispelled and life at the nest went on without interruption. At about noon the old birds were using the tent as a half-way house, alighting on its peak and guys, and foraging about it for food. In the space of four hours on the first day, during which the birds were watched at a distance of about twenty-seven inches, fifty-four visits were made and the young were fed forty times. The female brooded her young over an hour, fed them twenty-nine times, and cleaned the nest thirteen times. The male made eleven visits, attending to sanitary matters but twice. This example illustrates as well as any which could be given the advantage which attends the use of the observation tent.

On the following day, July 11th, the female was at the nest and brooding her young in five minutes after the tent was in position. Presently she left to hunt for insects, alighted on the tent, and five minutes later was feeding her young and cleaning the nest. In the course of nearly three and one half hours, fifty-five visits were made and the young were fed collectively or singly forty-three times. At about half-past eleven o'clock one of the fledglings left the nest and was fed by the old birds in the surrounding bushes of the swamp. The female brought food thirty-two times, cleaned the nest eight times, and brooded eighteen times for intervals varying from thirty seconds to eighteen minutes. This bird cut a queer figure while standing or sitting in the sun, with wings spread and bristling like a turkey-cock with every feather erect, and with mouth agape, trying to keep cool while shielding her family from the heat. Her breathings were at the rate of 150 to 160 times a minute. The male bird served food eleven times and attended to sanitary

matters once. In the course of forty-two minutes the first young bird to leave the nest was fed eight times, seven times by



Fig. 35. Baltimore Oriole inspecting young after having fed them.

the mother and once by the father. Three days later the swamp was visited at just after sundown, when the young birds suddenly arose from the nest and flew off with ease and precision.

Kingbirds pose so well, especially about their nests, that I

was anxious to see how they would stand the test of a sudden change in their surroundings. Accordingly I watched with unusual care two nests which were found near my house. On the thirteenth day of June one had two and the other four eggs all freshly laid, and these appeared to be the full complement. Young were hatched in each nest on or near the twenty-fifth of the month.

The
Kingbird

The first nest was built at the top of a hill, about a rod from an Oriole's nest (Figs. 35, 96), on the horizontal limb of a small apple tree twelve feet from the ground, and was a conspicuous object to all who passed that way. The nesting bough was removed and mounted in a good position on the morning of July 2d, and the tent was closed at half-past eight o'clock. At this time the two young were six days old and covered with light gray down. While the operation was in progress the old birds hovered over the nest, and with their usual boldness swooped down close to my head, snapping their bills and uttering their piercing alarms.

After the tent was closed, much to my surprise all became quiet, and I could see both birds—the female with insect in bill—exploring the nesting tree twenty feet away. She would fly to that point in space which the nest formerly occupied, and hover over it repeatedly, a characteristic action of many if not all birds under such circumstances, and is a good illustration of the force of habit. Ten minutes later the female was again at the nesting tree with insects. For an hour afterwards all was quiet. The old birds were sitting by in silence, probably not far away. At ten minutes before eleven o'clock one of the pair, probably the female, came with a swoop to the nesting branch, and I believe fed her young. In this case the observer had to wait two hours and twenty minutes before having the birds close to his eye, but he was well repaid for the delay as the sequel will show. In one minute the mother had returned and now both began to make up for lost time. In five hours and six minutes (from 10.50 A.M. to 4.36 P.M., allowing for an intermission of forty minutes when the observer was away), the old birds made seventy-five visits to the nest. Not only had they

become accustomed to the tent, but soon paid little heed to anything about it, and one could photograph them at will, focusing directly upon the brooding or standing bird. After I had entered the tent, they would be at the nest in five minutes



Fig. 36. Kingbirds rending an unruly dragon-fly. The female, who stands in front, was brooding when the prey was brought by the male.

or even less time, and the young were often fed at half-minute intervals. Occasionally both birds were at the nest together, but this seldom happened unless the female was brooding.

On the second day the male came to the nesting branch in twelve minutes after the tent was in position, and the panoramic scenes of life at this nest went on without disturbance for the rest of that day. The birds were before your eye, literally at

hand, and the observer had only to watch and record the rapidly shifting scenes with pencil and camera.

On the third day, July 4th, the female was on the bough in six minutes, and in six and a half minutes from the beginning of operations fed her brood.



Fig. 37. Kingbird family. The male—to the right—has captured a dragon-fly, whose stick of a body is seen projecting from the mouth of a young bird.

The fourth day of study at this nest, or the sixth from the time of displacement, was the most interesting of all. There were now two foster children in addition to the two born in the house, for I had transferred two birds from a former nest (No. 29 of table). No protest was made at this intrusion, but the strangers were adopted almost immediately and fed and guarded with all the care given to their own offspring.

In the space of four hours (8.54 A.M. to 12.50 P.M.) the parents made one hundred and eight visits to the nest and fed their brood ninety-one times. In this task the female bore the larger share, bringing food more than fifty times, although the male made a good showing, having a record of thirty-seven visits to his credit. During this long interval the young were thus fed on the average of once in two and one half minutes. At each feeding usually one and but rarely two birds were served. During the first hour the young were fed on an average of once in one and a half minutes. The observer was kept on the alert in recording what took place, and the scenes would often shift so quickly that it was difficult to decide which bird came to the nest. The mother brooded eighteen times, and altogether for the space of one hour and twenty minutes. The nest was cleaned seven times, and the nest and young were constantly inspected and picked all over by both birds, although the female was the more scrupulous in her attentions.

Whenever the male brought a large dragon-fly to the young, an exciting scene was sure to follow. If the female happened to be brooding at the time, she would seize the struggling insect and try to start it down one of the hungry throats. If she failed in this, the male would snatch it from her to try his skill, and usually with as little success. In this way the prey would be passed back and forth, until it was crushed between the bills of the two birds, or torn limb from limb. Some of these unequal contests between birds and insects are illustrated by the photographs.

When the male brought a moth miller and accidentally dropped it close to the tent, he went after it like a flash, and to place its security beyond doubt swallowed it himself. Again, one of the birds while perched near by was seen to disgorge the indigestible parts of its insect food, a common practice with flycatchers, both old and young.

I have added the foregoing details in order to show with what harmony life at the new nesting site proceeds when once the severed threads have been united. A knowledge of former conditions seemed to have been completely effaced. The nest-

ing bough was defended with the same bold spirit for which this bird is celebrated. The young were brooded night and day, while birds of other species were constantly assailed and driven from the premises.

At noon on the ninth day of July one Kingbird, then full-



Fig. 38. Warbling Vireo bringing insect to young. The rod-shaped body between the head of the bird and the branch is not a part of the tree, but the abdomen of a dragon-fly, which was dragged from its pupa-case, before its wings had unfolded.

fledged, was standing on the branch beside the nest. When touched he was off like a shot, and at this signal the others tried their wings for the first time and landed in the grass. After being replaced many times, two consented to remain, and spent that night in the old home, but forsook it the next morning when two weeks old. The first nest, which had been displaced in a similar way and which as we have seen eventually contained two birds, was occupied eighteen days. The last to leave flew easily two hundred feet down the hillside on the thirteenth of July. After taking this one home to secure a photograph, I carried him to the hilltop and tossed him in the air. In his second flight, which was long and good, he made a distant apple

tree. Both old and young birds remained in the neighborhood for several weeks, and were still there when I went away in early August.

As an appendix to this chapter, it might be interesting to add a few notes on other birds. On the twenty-third day of July a nest of Warbling Vireos was moved sixty feet to an



Fig. 39. Young Kingbird eighteen days old. "The last to leave flew easily two hundred feet down the hillside."

adjoining field, and to a point close to my house. In five minutes both birds were at the nest with food, the little Vireos giving their peculiar whining call in chorus, and the old ones their equally harsh and characteristic refrain—*kech-ech-ech-ech!*
kech-ech-ech-ech!

Observations were begun at once; the birds were remarkably active, and the amount of food consumed by the young was astonishingly great. During the first hour the nestlings were fed forty-five times and during the second thirty-two times, the feedings sometimes occurring, for a period of a quarter of an hour, at one-minute intervals. A Bluebird even came to the bough, took a perch close to the nest, and tried to hold its ground, but it was finally driven off by the male Vireo, who charged at it fiercely, with erect feathers and snapping bill.

At No Man's Land Island, Maine, I placed my tent beside a rock-nest of the Great Herring Gull, which contained two chicks and one pipped egg, amid the loud uproar of a panic-stricken

community. Forty minutes later, when the storm of this excitement had blown over, one of the Gulls came to its nest, and the strong smell of herring called attention to several families of chicks which were being fed close to my tent. Nevertheless, for two and a half hours the old Gulls stormed about their nest. With a loud explosive squeal one would suddenly descend like a bolt, striking the tent with both feet and with great force. Finally the male, closely followed by his mate, walked up boldly to the nest, and with piercing squeals called out his chicks and fed them on regurgitated fish. The nest was then inspected and the excreta carefully removed. Even then their fear had not wholly abated, for their mandibles kept wagging, as with mechanical repetition they uttered their less incisive alarm—*wak-wak-wak! wak-wak! wak-wak!* This gradually ceased, but, like the pendulum of a clock running down, the mandibles continued to work without emitting any sound.

I have camped beside the nests and preserves of five other families of Gulls with both eggs and chicks, but on the first day have usually found the old birds especially wary. On the second or third day, however, they would usually come to the perch or to the nest in from one to ten minutes. In order to save time in such cases, it is best to place the tent in position the day before observations begin.



CHAPTER III

TENT AND CAMERA: THE TOOLS OF BIRD-PHOTOGRAPHY

PHOTOGRAPHY has become so essential to the practice of the other arts and sciences that the student need not suffer from lack of advice, or of detailed manuals which treat every branch of the subject.

In the notes which follow I shall confine myself mainly to the results of personal experience in working with the tent.

The Observation Tent.—To satisfy the student and photographer of birds, the tent must not only afford a perfect means of concealment, but must be light, portable, easily adjusted, and to the fastidious—a most important consideration—comfortable for the worker.

The first tent constructed which meets these requirements fairly well, and has seen service for five seasons, will now be described. It is made of stout grass-green¹ denim, and with the frame weighs only six and one half pounds. It can be pitched in ten minutes almost anywhere, and may be compactly rolled, and carried for miles without serious inconvenience. It is 6½ ft. tall, 3 ft. 8 in. long, and 3 ft. wide, dimensions which will be found suitable for a person not much above the average height. One may spend any number of hours in it by day or night, and with a fair degree of comfort, excepting in very hot or sultry weather, when exposed to the sun on all sides. I have suspended operations but once on account of the heat, but there have been occasions when to have done so might have

¹ Brown or gray might answer as well. The green color serves to render the tent inconspicuous to both animals and men.

been better. More than once I have found it a welcome shield from the rain.

The tent frame is in three pieces, two upright poles or stakes with folding cross-bars, and an adjustable ridge-pole. The stakes should be from six to six and a half feet long, and may be easily lengthened at any time, as when the tent is to be pitched in a swamp or over mud and water. They are pointed at the lower ends which are set in the ground, and capped above with an arch of sheet iron to receive the ridge-pole. The latter is held in place with two pins or wire nails, which are pressed through a hole in the iron cap, and through the end of the ridge-pole into the upright stake. The eaves of the tent consist of a double fold of cloth projecting half an inch, to each corner of which is sewn a covered brass ring. When in position the tent is firmly guyed by small cords fastened to each ring. The flaps are placed at one of the corners, and may be pinned together when in use. The free lower border of the tent is fixed to the ground by wire pins, which may be pushed through the cloth at convenient places. From four to eight of these pins are needed, and each should be seven or eight inches long, and have a large soldered loop at one end.¹

The tent may be ventilated from above and made more comfortable on hot days by cutting out a large flap on each side of the roof, extending this a foot or less, and then guying each corner separately, at such an angle as to admit a free passage

¹For the benefit of the worker in the field I will add the following additional details: *Frame of smaller tent*; poles, 6½ ft. long, 1 inch wide, ¾ inch thick; *cross-pieces*, joined to upright pole 21 inches from top by a screw on which they have full play,—to be folded when not in use,—3 ft. ¼ inch long, ¾ inch wide, and ½ inch thick; *ridge-pole*, 3 ft. 8 inches long, ¾ inch wide by ¾ inch thick, with flat top, rounded only where they fit into the arched iron caps of poles.

Larger tent. A second and somewhat larger tent, which is more convenient for the use of larger cameras, was later made of green and white poplin, and is 6 ft. 10½ inches tall, 3 ft. 4 inches wide, and 3 ft. 8 inches long; peak 21 inches in vertical height from eaves. *Tent-poles*, 6½ ft. tall; *cross-pieces*, 3 ft. 4 inches long; *ridge-pole*, 3 ft. 8 inches long, all made of pine and slightly heavier than in smaller tent.

of air under the peak. For convenience I prefer the simpler form.



Fig. 40. The tools of bird-photography; the tent rolled up in portable form at right.

After working during the summer of 1899 with the tent I saw for the first time the interesting work of the brothers Kearton,¹ in which a different kind of blind is used. They devised an imitation

¹ *Wild Life at Home: How to Study and Photograph It.* By R. Kearton, illustrated by C. Kearton. Cassell & Company, 1899.

tree-trunk, having a skeleton of bamboo rods and a covering of galvanized wire and green cloth, large enough to hold the photographer standing erect with his camera. The outside was painted in imitation of bark and decorated with moss and leaves. This was used in cases of nests placed on or near the ground in favorable situations. Mr. Kearton says it would hardly do to set this up beside an exposed nest like a lark's "in the middle of a bare ten-acre field," and to suit such a case they constructed an artificial rubbish heap, from which photographs were successfully made.

Such devices are of course unnecessary when the nesting site is brought under control, since in this case the birds must become accustomed to a changed environment, and the addition of the tent is a factor of no great importance. Then again, the great heat of summer would prohibit their use in most parts of this country. No decoration of the tent is commonly needed, and its color is a matter of minor concern. Aside from the question of comfort, however, the advantages of the tent lie in its convenience and portability. It is a simple means of attaining what is chiefly sought, perfect concealment. The reason it had not been adopted before possibly arose from the fact that the readiness with which many birds become accustomed to strange objects, or form new habits, had not hitherto been appreciated. What wild animals chiefly fear are strange sounds and strange objects in motion. All things at rest, whatever their form or color, are soon disregarded by birds, of which fact the reader will find abundant testimony in the course of these pages. On the other hand, it is well to remember that individual and specific differences are very great, and one should not be surprised if some cases are found in which the tent or any similar blind will not work with success.

The Tent in Use.—Some difficulty may be experienced in pitching the tent in exactly the right position with reference to the nest, without the necessity of further change. The factors to be borne in mind are the height of the sun, the focal length of the lens, and the position of the window to be made in the tent-front directly opposite the nest. The front of the tent

should be parallel with the nesting bough (when there is one), and the long axis of the latter should be parallel with the sun's course. The tent is so placed that the nest is in direct line, not with the middle of the tent, but with the window to one side. When the observer stands within, facing the nest, the window lies to his left, at one side of the vertical pole, and either just over the cross-piece or somewhere below it, depending on the height of the nest from the ground. The tent will not overshadow the nesting bough when once set in proper position.

If the focal length of the lens be $6\frac{1}{2}$ inches, and the nest that of a Cedar Waxwing, which is mounted at the height of four feet, and the tent be so placed that the front of the lens is twenty-eight inches from the rim of the nest, we shall get a picture with adequate setting on a 4 x 5 plate, like many shown in the engravings. With lenses of longer focus, which it is advisable to use if possible, it is not necessary to approach so near.

When the position has been determined, the tent-poles are set firmly into the ground, the ridge-pole adjusted and the tent-cloth thrown over it. It saves time to lay one end of the peak in position and draw the other over to its proper place. The cross-pieces are then lowered from the inside and the guys loosely set. A flap about six inches square is then cut with scissors in the front of the tent, to the left of the pole opposite the nest, which can be viewed through the opening. Should the position subsequently prove to be wrong, the poles may be raised both together and reset. When everything is right the guys are tightened, and the free edges fixed to the ground with wire pins, which will hold the walls taut and prevent excessive flapping when there is wind. It is often convenient to have the flap at the front on the operator's left so that one leg of the tripod may project through it.

The proper adjustment of the camera follows, the nest being the object focused until the old birds appear. I have found it advantageous to pin the focusing cloth firmly around the camera so that it is always in position for use, and to stretch a piece of green denim on the side of the camera next the observer,



Fig. 41. Last hour of life at the nest of a Chebec family, consisting of the mother and three young birds, only two of which can be seen. June 25, 1902.

fixing it between the front fold of the focusing cloth and the tent so that it hangs vertical, and effectually conceals the operator when standing upright and setting the shutter. Peep-holes are made to command all directions, and of course the nesting bough to which attention is mainly given. It is convenient to make small V-shaped openings which can be pinned up or down. A bird will sometimes detect some movement of the eye when close to such openings, so that they should not be made larger or more numerous than necessary.

When a photograph has been made and the shutter is to be reset, the vertical flap is released from the focusing cloth and carefully drawn over the window, if the birds happen to be at the nest, as when the female is brooding. Otherwise, if timid or unaccustomed to the new conditions, the movement of the hand may be a source of alarm. I have successively photographed family groups without disturbing them, when at a distance of twenty-eight to thirty-six inches, after they had learned to disregard the click of the shutter. When a window in a different position is wanted, the old one is patched up and a new one made.

Photographic Screens.—The advantages offered by white or neutral screens are most appreciated where no good natural background is available, and especially when birds of dull or spotted plumage are to be photographed against a background which is spotted by foliage or by undesirable objects of any kind, which strongly reflect the light.

To be of much service the screen should be fairly large, and with frame and supports it is too cumbersome to be carried in the hand, except for short distances. Yet, one is often repaid for the extra trouble involved in its use by a series of clear-cut portraits, which could not be obtained in any other way. (See Figs. 11, 16, 43.)

For ordinary purposes a sheet of white cotton, seven to eight feet long by six to seven feet wide answers well. This is tacked on a folding deal frame, and erected at a distance of from five to six feet behind the nest, or at a point sufficiently out of focus of the lens.

Protective Screens or Nets.—Whenever the nest is in a vertical trunk of wood, as in the case of Woodpeckers, Chickadees, or the little House Wrens, and this is mounted on a pivot, the whole may be easily defended from cats and other enemies by means of a flange of zinc or tin-plates, encircling the stump at the proper height, or projecting from the block to which the trunk is secured.

A circular enclosing net may also be used, and this is necessary whenever a horizontal branch is supported on stakes. For this purpose there is nothing better than the common galvanized iron wire-cloth netting of one quarter inch mesh. It should stand at least three feet high, and should be pinned close to the ground by wire staples. To this an overhang one foot wide (of looser "poultry" netting), must be added all the way round. Such a screen is warranted to stop the cat, as well as every rodent and snake, large or small.

Camera.—Any good long-bellows camera with reversible back will answer, the size and weight being the considerations of greatest moment. Most naturalists and sportsmen, who travel long distances and carry their own traps, find a camera which takes a 4 x 5 plate the most convenient and economical. I commonly use this when working with the tent, but often prefer the 5 x 7 size because it gives a larger and better picture of the object sought. The large camera with a heavy lens may be a drag on the mind and body of the most enthusiastic pedestrian, but one is usually amply repaid for the greater trouble involved. For long journeys, however, the lightest possible outfit is decidedly preferable. In general field work, moreover, a hand-camera, carrying film of the $3\frac{1}{2} \times 4\frac{1}{2}$ inch. size, is always in demand.

In working at short range with lenses of moderate focus the long bellows is a necessity, and at the same time enables one to take full-sized pictures of small objects, as well as to use the telephoto lens should this be desired. The reversible back, making it possible to reverse the position of the plate without moving the camera and often without disturbing the bird, is an adjunct of the greatest convenience.

While the best tools are always to be desired, excellent pictures can be made with a cheap outfit, provided the lens is rapid enough. Nearly all of my own work has been done in the



Fig. 42. Observation tent on raised platform, and photographic screen for studying a Red-eyed Vireo's nest in its natural position. See Figs. 60 and 66.

tent with the birds at hand, but in taking quick shots of birds or quadrupeds when there is no lure to chain them to a given spot a hand-box camera is needed. The lens should be of long focus, and the adjustments such as to enable the operator to

focus and expose as nearly simultaneously as possible. To meet these requirements the twin-lens and reflecting cameras, both of which are old inventions,¹ have in recent years been placed on the market in improved and serviceable forms.

The "twin-lens" consists of two cameras, set one above the other, the bellows of which move as one. The lower takes the picture, while the upper gives the image which is reflected on a glass plate set in the top of the box. Besides being expensive and heavy, the trade sizes of these cameras are apt to be of too short focus to be of much service to the animal photographer.

The reflecting camera does the work of the two lenses with a single lens and bellows, and in the recent designs² is provided with a focal plane shutter, which is the best for exposures quicker than the $\frac{1}{100}$ second mark of ordinary shutters. Like the upper half of the "twin-lens," it has a movable mirror, set at an angle of 45° , which casts the image made by the lens on a plate of ground glass set in the top of the box and shielded by an adjustable hood. The mirror is so placed between the plate and lens that the distance from lens to sensitive plate equals the distance traversed by light in passing from lens to mirror and ground glass. When the object is focused, a lever is pressed which raises the mirror and automatically releases the shutter. One must expect to find the image on the ground glass somewhat dimmer than when no interposing mirror is used. To be most serviceable this camera should have a long bellows.

The Lens.—In animal photography, short- and long-focus and telephoto lenses are available. My own experience has been mainly limited to the following: Zeiss Anastigmat, Series ii a, $6\frac{1}{2}$ inch., speed $\frac{1}{8}$; Convertible Anastigmat, Series vii a, combined

¹ The principle of the reflecting camera was applied as early as 1860, and various forms of the reflex type were devised during the next thirty years. In 1891 Dr. Krügener of Frankfort brought out his "Normal Reflex-Camera," in which the construction, though somewhat complicated, was much improved. The principles are essentially the same in the later designs: see *Ausführliches Handbuch der Photographie*, by Josef Maria Eder, Halle, 1891.

² The improved Graflex camera, manufactured by The Folmer and Schwing Mfg. Co., New York, is excellent in design and workmanship.

equivalent focus 8 inches, speed $\frac{f}{6.3}$; Extra Rapid Universal Lens, Series D, $9\frac{7}{8}$ inch., speed $\frac{f}{6}$; Plastigmat, No. 4, $9\frac{1}{4}$ inch., speed $\frac{f}{6.8}$.¹

The convertible anastigmats are convertible in two or three lenses of different foci, according as the single anastigmats are of equal or different foci. They thus combine in a single lens the possibilities of working with short and long foci, the greatest speed being obtained when each system of the doublet has the same focus.

The cheaper plastigmat lenses are equally serviceable for work in the field. In these the rear lens, which has twice the focal length of the doublet, may be used separately, but of course with a greatly reduced speed. Those who have worked also with the Goertz lenses of similar focus and speed will find little to be desired in the possibilities of the best photographic instruments.

In photographing animals close at hand, the anastigmatic qualities of a lens count for little. It is depth of focus combined with high speed which are most needed, consequently any lens possessing these qualities will answer.

One of the most difficult problems in bird-photography has hitherto been that of approach within "shooting" distance. The control of the nesting site and the use of the tent offer a solution so far as life at the nest is concerned, in at least many species, and the tent in its general use does away with the need of the very long-focus or telephoto lenses.

In photographing birds sitting, brooding, or standing at the nest there is no difficulty with a lens of speed $\frac{f}{8}$, which requires $\frac{1}{25}$ second to fully expose the plate, at a distance of twenty-eight inches with full lens and strong light. With scenes in which the actors are in constant motion, however, we require a much faster lens, which will reduce the exposure to at least $\frac{1}{60}$ of a second. But little is gained, however, in attempting to use long-focus lenses at such short distances, since in stopping the lens to ensure the proper depth of focus we are certain to

¹ These lenses are made by the Bausch & Lomb Optical Co., Rochester, N. Y.

sacrifice too much light. When large pictures are desired, better pictorial results are obtained by increasing the distance



Fig. 43. Female Flicker entering nest. Compare with picture of mate (Fig. 137), in which regurgitation of food is in progress. The spotting of the under parts is very different, and in this bird the black crescent on the breast is divided in the middle. July 25, 1902.

and using lenses of moderate focus. Having once obtained perfect negatives, enlargements on bromide paper are easily made.

For photographing inaccessible nests, and birds which pose well but are unapproachable under ordinary conditions, we must resort to the long-focus and telephoto lenses. The long exposure required for the telephoto lenses now on the market, from one half a second to a second or more, restricts their use to comparatively rare and lucky chances.

The Tripod.—When two cameras are carried of the 4 x 5 and 5 x 7 size, a single tripod will answer for both, provided it is moderately stiff about the head. A two-length tripod of medium weight will serve most purposes, but a shorter one is also required for nests on or near the ground. This is best made by cutting down one of the ordinary kind, rather than resorting to those of the multifold type, which, unless made of metal, are constantly spreading and slipping at critical moments.

The "Graphic" ball-and-socket clamp, used as a camera holder for the bicycle, has been strongly recommended as a substitute for the tripod or as an adjunct to it, as in photographing nests in trees, when the clamp, which is screwed to the camera, is fastened to a convenient limb, but since my own work has been of another kind I have had little occasion for its use.

The Shutter.—In photographing birds whose sense of hearing is well known to be acute, next to a good lens a silent shutter is most needed, especially when the camera is less than three feet away. The shutter which is silent not only in name but in actual use and at all speeds is still one of the greatest needs in the close-at-hand photography of animals, and especially of birds.

Birds will often jump into the air as if shot, at the first click of the metallic shutter. Fortunately, however, the force of habit now comes to our aid, since they gradually learn that it is harmless, and may be safely disregarded.

The "iris diaphragm shutter," which I have mainly used, is often troublesome in that some part of the sound arises at the very beginning of the exposure, so that a startled bird in the course of $\frac{1}{20}$ of a second may be all over your plate. The

marks on all such shutters, which are conventional rather than exact time measurements, differ in different shutters of the same or different make, and their limit of rapidity does not



Fig. 44. Female Brown Thrush stepping into her nest to brood.

exceed " $\frac{1}{100}$ second." For greater speeds the focal-plane or some other very rapid shutter must be used.

Plates.—For animal photography the most rapid plates are none too fast, and any of the best brands can be recommended.

It is always a good plan to adhere to one kind which has proved satisfactory. One piece of advice should not come amiss, which is to always use fresh plates, and all of the same emulsion if possible, and if any doubt as to their age exists, to test them before starting on an expedition. Old plates blacken along their edges in a characteristic manner when placed in the developer, and if deterioration passes this stage the whole plate will fog. The dusting of plates, slides, and holders before reloading, and the carriage of all unused plates in a dust-proof bag, are as much a necessity now as ever.

Much of my own work has been done in the country with dark room and base of supplies close at hand. Under these conditions it is not necessary to carry more than two or three dozen plates at a time. By developing on the day of exposure it is possible to correct errors or fill up the gaps on the day following.

When time exposures can be given, orthochromatic plates offer advantages which should not be neglected, but when the exposure is necessarily rapid, the ordinary and cheaper plate is equally good.

Flash Light.—The Ideal Flash Gun (size No. 2) has been highly recommended for use either at night or on dull days. It burns luxo powder, a powerful compound, which should never be confined in an ordinary flash-lamp, and must be handled with exceptional care.

Record of Observations.—It is perhaps unnecessary to suggest that all records of observations should be systematically made on the spot and with great care. Experienced students generally develop a system of their own, which in many cases suits their needs so well as to leave little to be desired. I venture, however, for the possible benefit of a few, to describe my own plan, which has the merits of extreme convenience and simplicity.

All field records and notes of every description are made on punched, and generally ruled, sheets, of uniform size, measuring $3\frac{3}{4}$ by $6\frac{3}{4}$ inches. These are temporarily "bound" in stiff card-boards so as to open the long way, by means of adjustable rings

or simply with strings, the ends of which are joined to prevent the knots from running into the book. When in use the book is turned inside out, so that the covers, which are brought together, afford a firm support for the pen or pencil. The size of the book is adjusted to the needs of the day, and is always comparatively light. When the pages are full, the notes are filed and the sheets are renewed. At the end of the day, week, or year the notes are assorted, and those pertaining to a given subject, falling into their proper place and in chronological order, are "bound," or tied up, with proper titles, in a series of booklets. A book is devoted to every important subject, while all miscellaneous notes are temporarily gathered into a single "volume." The only rule required is to use separate pages for each subject. The system is perfectly elastic, and combines the advantages of a card index and ordinary notebook, without their defects. In the course of time, in place of a series of cards, scraps, or records of observations buried in notebooks, an orderly series of "volumes" appears. The notes upon a given subject are always in their proper place, and that place can always be found. This method can be used with equal advantage, whatever the nature of the subject.

Accessories.—The minor articles which are needed to complete the photographer's outfit, all of which can be rolled up with the tent or, better, carried in a hand-bag, will be suggested by a little experience in the field. A saw, hatchet, and nails are often required, as well as scissors, pins, the supply of which is always liable to run out, and a small hand-mirror for use in setting the shutter from the rear. A toilet hand-mirror which can be turned at any angle is a convenient means of inspecting the interior of nests inaccessible to the hand, but within reach of the mirror attached to a pole.

CHAPTER IV

THE ROBIN AT ARM'S LENGTH

NO bird is better known in America than the Robin who annually visits nearly every part of the continent. Upon the whole it shuns the forest and comes to the haunts of man, to the farm, the village, and the city street, with their attractive orchards and parks, their long lines of shade trees and green lawns.

Is it possible to say anything new about such a familiar personality? Not much, you may think, yet it will be interesting to study our friend at a closer range than is usually possible. In this case we shall "make the mountain come to Mahomet," or bring the nest from the treetop to a point nearer the ground, where there is no foliage to obscure our vision, and where we can see everything that transpires within reach of the hand.

Birds differ slightly in every bodily character, as well as in every mental trait, and while we commonly meet with average types, extremes of temperament are by no means rare. This fact is illustrated by the Robins whose history follows.

One pair dwelt in the woods and was exceedingly wary, while the other was comfortably settled in town, and lived on a familiar footing with man. The town Robins had, I suspected, already led forth a brood from a pine tree on the bank close to my house, but at all events there was a new nest in the apple tree on the top of the hill, and on the twenty-fifth of July the mother bird was sitting on three blue eggs. Incubation lasted about two weeks, and life at the nest about twelve days.

When the young were eight days old, the entire bough was sawn off, carefully lowered to the ground, and set up on the

hillside. In exactly fifty-five minutes from the beginning of operations the mother appeared with a large grasshopper, which she gave to the young, and afterwards cleaned the nest. The



Fig. 45. Female Robin brooding on a hot day—her left wing pushed up by a young bird.

male came also, when the comparative safety of the new conditions had become apparent, but approached with more caution. At first both birds flew to the tree by their accustomed paths, and examined the place where their bough had been

lopped off, and in their admirable and fearless manner blustered about for a while, taking no pains to conceal their anger. Of course they knew where their young were all the time, for in certain directions their vision is keener than any man's.

We know well with what confidence the Robin flies to its nest when no danger threatens, but under the present circumstances their suspicions might well have been aroused. The absence of sound and motion in strange objects is always reassuring, and soon Mother Robin could be seen perched on the top of an apple tree, surveying the field. She called *seet! seet!* while the grasshopper in her bill squirmed to get free, and the young chirped loudly in reply.

When their behavior is free and spontaneous it is pleasant to see these birds act promptly without apparent hesitation. They haggle over nothing, but follow the bent of their strongest instincts. In the present case, the fear which controls them for a time and overpowers their strong parental love is gradually worn away. Suddenly down comes one of the old birds with all its weight on the limb. The young have felt similar vibrations before and know what to expect. Up go the three heads at once, each mounted on a slender stalk, and each bearing at its apex what might suggest a full-blown, brilliant flower, for, as is well known, the extent of their gape is extraordinary and the inside of the mouth has a bright orange hue. The young tremble with violent emotions as they jostle, struggle, and call with undiminished zeal even after being fed.

After the first visit had proved successful, and confidence was established, the female and later the male came to the young at intervals of about five minutes, bringing grasshoppers, and occasionally removing the excreta or devouring it on the spot. They frequently carried five or six insects at one load, when their bills would suggest a solid stalk of grasshoppers, all struggling to get free.

They waste nothing, and rarely allow a cricket or grasshopper to escape, but, releasing one at a time, see it safely down an open mouth. Then after inspection is over they fly to the nearest perch and make haste to clean their bills and set their



Fig. 46. Male Robin serving a cluster of angleworms and a grasshopper. Notice his position here on the right as in all other pictures of this nest. See Chapter XIII.

dress in order. This done, there is often a pause of a few moments, as if in doubt whether to hunt more grasshoppers, to dig angleworms in yonder cornfield, or to try the cherry trees along the fence-row. They will take everything which their sharp eyes discern, and often pick up an insect close to the nest.

One Robin at the age of eleven days left the family circle early on August 13th, and at nine o'clock the two which remained were standing up and flapping their wings. The old birds would come near, displaying tempting morsels in their bills, but with no intention of feeding their young so long as they remained on the nest. By such tantalizing methods they soon drew them away. Both old and young hung about the apple trees for several days, when they disappeared and were not seen again.

At the stage of flight the young Robins have several distinct call and alarm notes like those of the adult birds. They can take short, low flights, can hop briskly, and go to cover instinctively whether with or without warnings from their parents. They will also lie quiet in the grass, as in hiding, a common instinctive act.

The second family of Robins nested high in an oak, and whenever they were approached the old birds made an admirable show of pugnacity, scolding, screaming, erecting their feathers, snapping their bills, and darting straight at your head. Their nesting branch was taken from the woods to a bare, open field, and set up sixty feet from the tree in the way already described. The first morning's experience was rather discouraging, for neither bird would come to its nest while the tent was in front of it. They called plaintively from the trees, and circled about the nesting bough again and again, but always kept at a distance. Accordingly, after feeding the young, I decided to strike tent and wait until next day. There was a heavy thunder storm in the afternoon, but when I visited the nest towards evening I was pleased to find the young as lively as ever, and the old birds on guard with their usual spirit and tenacity unimpaired.

The next morning they stormed vigorously about the tent

and the male even came to the nest while I was standing near. After closing the tent I was under the cross-fire of their wrath for seven or eight minutes, when the alarm calls suddenly ceased, and in two minutes more the mother was on the nesting bough. The female actually came to the nest or to the branch which held it eight times in succession, in the space of twelve minutes, with insect ready but without delivering it. Matters did not altogether please her yet, and with a shrill *seet! seet!* away she would go, but only to return a half minute later. Finally she came boldly to the nest's brim, uttered a sound like *cuck! cuck!* which means "Open wide!" and produced a number of sturdy-looking grasshoppers. Two minutes later the mother came again, and after feeding the young, picked them all over, spending a minute and a half in the duties of inspecting and cleaning. It was a hard task to conquer these birds, but they had to submit to the inevitable, and I have no doubt but a few days more would have brought them to the hand.

The greater strength of parental instinct in the mother was well illustrated by the behavior of these Robins. The female was always first at the nest, and came at forty minutes after nine o'clock on the second day. The male, though constantly skirmishing about with bill loaded, was not on the branch with food until two hours and ten minutes later. Meantime the mother had been giving the young her constant attention. The cock, though at the nest or on the bough several times, did not actually have the courage to feed his little ones until long past noon. In the performance of this duty he was three hours and four minutes behind his mate.

When the male did come at last and deliver food, he gave the nest a good cleaning, and flew off to a corn patch a hundred yards away. In thirteen minutes, during which interval the female had brought grasshoppers twice, the male returned triumphantly with a great cluster of writhing angleworms. After safely dispensing them, he went the rounds of inspection, devoured the excreta, then stood for a full minute on the rim of his nest and with crest erect called, *wit! wit! wit!* as if to celebrate a victory and announce his bravery to the world. Now

and again the cock came to the nesting bough but without food. He wished only to take a look and see that all was well. At one of these visits he stood on silent guard for full ten minutes, then sped away, calling loudly, *wit ! wit ! wit !*



Fig. 47. Cock Robin standing at inspection, after having fed his young.

When eight days old, on July 26th, the young began to present their spotted breasts over the walls of the nest and to spread, stretch, and flap their wings, the quills of which now showed half an inch of feather at the tips. At every visit of their elders the whole brood went wild with excitement, but soon quieted down, and the intervals were spent in preening

their sprouting feathers, calling for more food, or dozing with heads hanging down over the edge of the nest.

The third day opened warm and clear, and towards noon became very hot. Mother Robin began to brood at twelve o'clock and for the space of three hours was on and off the nest constantly, rarely remaining longer than ten minutes at a time either at her post or away from it. On the fourth day, July 28th, which was destined to be hotter still, brooding began at exactly eighteen minutes before ten o'clock, and the mother was quietly sitting over the little ones when the tent was struck long past noon.

Many charming scenes were enacted at this nest during the day, but colored phrases or colorless pictures do them scant justice. You must fill in the backgrounds of soft blues and greens, and add the touch of life and color to the actors on the stage.

The following extracts from my notes of this day may give some idea of the panoramic character of the scenes, in which the element of repetition is not wanting.

July 28, 4th day in tent. 10 A.M. The female comes to the back of the nest, delivers food and goes the rounds of inspection and cleaning, devouring the excreta on the spot, then settles down on the margin of the nest, steps in, and gradually tucks the young under her breast and wings.

10.12. A whirring sound announces the coming of the male. He approaches always on the observer's right, and deliberately hops down to the nest. He is bringing a big cluster of earthworms. The young get the message the moment the branch is touched, and poke their heads out from under their mother's tail, wings, and head, sometimes raising her bodily, and almost tipping her over. However, she holds her place until her mate is close by, then hops up and stands to one side, finally leaving him to deliver what he has brought.

10.15. The mother is back with food, but it was down the throat of a young one before I could tell what it was. Cleaning and brooding followed in due course as before.

- 10.18. Cock Robin comes again, but my eye was again off the nest, and in a moment the business was done. Mother Robin stays and broods. I change the shutter, open and close the tent window, without giving her any apparent anxiety.
- 10.30. Another visit from the male, who comes quickly, delivers a grasshopper or two and departs, while his faithful mate resumes her post of duty.
- 10.45. The cock brings another coil of angleworms, and the hen, leaving her charge just long enough for the business of feeding, drops back on the nest.
- 10.55. The male is taking it easy. This time he has an unusually large grasshopper, which is not cut in twain, but delivered whole. At the signal of his approach the mother leaves, having brooded forty minutes by the watch.
- 10.57. Two minutes elapse. Back comes the *alma mater*, loaded to the muzzle with blueberries, which are shot out one by one, and strike the yellow targets in the bull's eye every time. She comes to the farther side and broods at the moment the preliminary work of feeding and inspection is over.
- 11.16. The male has now brought a load of bright red chokecherries. He hops down the branch by the usual path and up to the nest, but the female, who is brooding, strangely keeps her position and, whether from absent-mindedness or caprice, refuses to budge. When the male gives an impatient *cuck! cuck!* the mother can keep her position no longer, for the young upset her equilibrium in their struggle, and she hops to one side. Resuming her place she sits there in the bright sunshine, with back to the tent, mouth agape, and crest erect. Twenty inches away are the tent, the camera, and the eye of the observer, but for none of these things does she now care a straw. They have been thoroughly tested and found harmless.
- 11.43. Cock Robin is on hand with a beak full of grasshoppers,



Fig. 48. Female Robin inspecting her household immediately after the young have been fed: a characteristic attitude.

coming, as is now his invariable custom, to the right side. On this occasion the mother hopped up promptly and received a part of the food into her own bill. Did she eat it? Not a particle! The young got it all. The male then retired, followed closely by his mate. In one minute she has captured prey and is back to her brood. The young erect their crests like their elders, and flapping their half-fledged wings, try to climb to the edge of the nest, but without success.

The last day of July opened hot and sultry, and when I approached the nest one young Robin was already out, and making for the highest point of the nesting bough. He cheeped aloud for food, and looked uncomfortable, for the heat was already strong. The male only was in attendance as on the previous day, the female being occupied, as I suspected, in starting a new nest.

It was difficult to get any food past this enterprising fledgling, who stood in the path and took everything that was brought. Several times the bird would make a move as if intending to fly to the peak of the tent, and might have done so, had I not decided to replace him in his nest. The expected certainly happened, for all tumbled out, shrieking and squealing. Put them back and out they would go again, and flop down on the grass. At last two birds consented to remain for a few minutes, when the male came with an angleworm and a large green katydid. He paused a moment while I photographed him, and this proved to be the closing scene. The curtain dropped suddenly, when first one bird and then the other left their home forever, not even waiting to get the katydid. The old bird at once led his brood to the woods, and being able to take short flights they had no difficulty in finding safe quarters.

The number of times the young are fed in the course of the day depends upon their age and the weather. The older they are the more food they require. At this nest the labor of feeding and cleaning was shared about equally by both birds, but on hot days the female was necessarily less active since there was much brooding to be done, and the instinct of the male is but feebly developed in this direction.

The following table illustrates the relative activities of this pair in caring for their young, the time of observation being approximately from nine o'clock until three in the afternoon.

PERIOD OF OBSERVATION.	SECOND DAY.	THIRD DAY.	FOURTH DAY.
Age of young.....	8 days	9 days	10 days
Fed by male.....	15 times	24 times	15 times
Fed by female.....	18 times	28 times	14 times
Brooded by female...		6 times (44 min.)	3 times (2 hours 41 min.)
Rate of feeding.....	Once in 11-12 min.	Once in 7-8 min.	Once in 8-9 min.
Period of observation.	9.30 A.M. to 3.53 P.M.	9.05 A.M. to 3.44 P.M.	9.11 A.M. to 1.58 P.M.

The nature of the food, which depends much on the local supply or the condition of the market, consisted mainly of grasshoppers and angleworms, to which we must add a few insect larvæ, beetles, locusts, and katyids, while the list of fruits included blueberries—most in favor,—choke-cherries, and raspberries.

As to the sanitation of the nest, inspection, as we have seen, follows each feeding. The nest was cleaned during the period given in the table every fifteen minutes, and mostly by the female, who devoured a part of the excreta at the nest and carried the rest away.

The Robin has been known to pass the winter in Nova Scotia, where it feeds on wild dry fruits, like dogwood berries, and at all intermediate points between its northern and southern ranges, wherever the food supply is good. Thus in the cold valleys of the White Mountains, where there is snow during the greater part of the year, and where the mercury sometimes freezes, flocks of Robins are said to spend the winter, feeding on the wild berries which are cached above the snow. The winter birds are probably in most cases migrants from farther north.

The food of the Robin consists, as we have seen, of small animals, mainly insects and worms, and of wild fruits in about equal quantity. It has been shown¹ that cultivated fruits are

¹ By Beal who found forty-two per cent. of animal matter in three hundred and thirty stomachs of these birds.

eaten only as a makeshift and mainly in the months of June and July.

Spring Robins reach Cleveland, Ohio, on the last days of February or the first of March, central New Hampshire the



Fig. 49. Female Robin in act of cleaning the nest.

third week in March, and I have seen them in Burlington, Vermont, on March 30th. A few Bluebirds are usually reported on the same day. In 1900, Robins were heard or seen in different parts of Cleveland on the ninth of March, a mild, bright day, while but a week before the country was in the grip of one of the worst ice-storms ever known in this region. Every ex-

posed object was incased in solid ice for days and the birds fasted or starved.

In the choice of a nesting site, the Robin, as we have seen, obeys no law. The apple tree, which from its mode of branching yields wide open crotches and safe horizontal supports, is generally chosen, but they also resort to the leafy elm, the evergreen, the dense and remote woods, or, like the Phœbe, accept the hospitality of barn, porch, or shed.

Where the nest has already begun to crumble into ruins by the time the young fly, it is often abandoned and a new one built for the second brood, but whether a new nest shall be built or not depends more upon the strength of the building instinct or individual caprice than actual need. The old nest is sometimes repaired, or even occupied without change during the same season. On the other hand, three nests are sometimes built in line and under cover, where a single one if put in good repair would have answered the purpose. I once saw a Robin's nest fixed to the end of a stick of wood that leaned against the side of a barn, and the stone-gray color of the background formed an excellent screen for its concealment.



Young of the European Blackbird
or Ousel, first cousin of the American Robin.

CHAPTER V

THE CEDAR-BIRD

ON the twenty-seventh of May, I saw a small company of birds settling in the topmost branches of an elm. You might infer from their behavior that they were new arrivals. They keep together, sit prim and erect, and move about as if under discipline. With a glass you can see their erected crests, their sleek drab plumage, and recognize at once the familiar Cedar- or Cherry-bird.

At Northfield, New Hampshire, the earliest nests have eggs by the first or second week in June, but the breeding season is not at its height until the last of July or August. A few still have young in the nest in early September, when many are flocking or have already started southward. Professor Baird speaks of finding these birds sitting on their unhatched eggs as late as the twelfth day of October.

The winter flocks of Cedar Waxwings, which are occasionally seen in northern New England, are probably migrants whose summer home is farther north.

The Cedar-birds borrow no trouble from their neighbors, and seem to lead a life of ease and pleasure, lessening their denominator when the times are hard, but living high when cherries are ripe. The nesting season, which brings much that is sweet and bitter to the lives of most birds, appears to give them the least anxiety. The immaturity of their eggs at a time when most of our birds have already reared their first broods is a striking fact, and is due to some unknown cause which retards the growth of the ovaries. It is evidently not caused by a lack of suitable food as some have supposed for the seed-eating

Goldfinch, whose wants are well supplied, is equally dilatory in its nesting habits. The young Cedar-bird gets about the same kind of food as the young Robin or Oriole, and it is not likely that a greater or less amount of fruit in the diet of old or young would sensibly alter their condition. The Goldfinch, whose eggs hatch in late July or in August, feeds its young on the seeds of thistles, but this does not prove that the seeds of other plants would not do as well, or that young Goldfinches, if hatched in June, would starve. Almost equally remarkable is the early nesting of Crossbills and Ravens.

So quiet and retired is the Cedar-bird, it may live in comparative seclusion although not a rod from your house, and may remain on your grounds for the whole summer unnoticed, unless some one is on the watch, so that the name "chatterer," formerly applied to the family, can have only an ironical significance in this least garrulous of birds. The fondness of this bird for the berries of the red cedar and for cherries is responsible for two of its commonest names, while the term "waxwing" has reference to the peculiar horny scales of the secondary wing-quills, which look as if tipped with red sealing-wax. Less commonly, the tail also bears similar appendages, but there is much variation in their appearance in both old and young. Most of the birds which I have studied at the nest have been entirely lacking in appendages of this kind. In some cases all the nestlings show the red tips at about the eighth or tenth day, or at the moment the feather-tubes of the secondaries burst, while more frequently only one or two in the nest are thus ornamented.

Late in spring the Cedar-birds are seen coursing about in small squads, selecting some treetop for an observatory, and always showing the most marked uniformity, there being little to distinguish the sexes in either size or color. Their plump oval forms and easy undulating flight are characteristic, and their manner of flying and perching in compact bodies as one bird should not escape the observer. Apple trees of moderate size are in high favor, since they afford such fine opportunities for nest-building, and are usually surrounded by good feeding grounds.

When they do not come to orchards and the neighborhood of houses, Waxwings usually frequent scrubby pastures, selecting



Fig. 50. Female Cedar-bird prepared to regurgitate food from the gullet. Notice the outlines of the neck, which mark the full throat. "Twenty minutes later, the last fledgling had left the nest." August 25, 1899.

the witch-hazel or thorn-apple bushes by preference, and occasionally a small sapling oak or maple. The nest is either set in a fork or saddled to a spreading branch, at a height of

from five to twenty feet. It is nicely wrought from vegetable and animal material such as dead grass, roots, fine twigs, weed-



Fig. 51. Cedar-bird chorus at the most exciting moment just before food is served, August 6, 1899, two days before flight and the development of the sense of fear. First picture made by method described in this book. Life-size.

stems, pine needles, wool, yarn, and twine. One of many nests built in an orchard was composed of dead clover stems, witch grass, with thistle-down and the fluffy heads of the Indian

tobacco, a plant growing close by, worked over its rim and interior.

Four or five eggs are ordinarily laid, but the total product of ten nests which I examined in 1899 was only thirty-six eggs, out of which about twenty-five young were hatched and from sixteen to twenty reared.

The parental instincts during the early days of nest-building and incubation are often weak, and this is shown to a marked degree in the Cedar-bird, which is easily robbed and ever ready to take fright and abandon its eggs.

One year, in July a pair began to collect nesting material in an apple tree in full view from our porch, and I frequently watched them at work through an opera-glass, and once or twice passed under their tree. This inspection of their private affairs pleased them so little that they left their completed nest, and moved to the adjoining field a few rods away, where there was less publicity, and where five eggs hatched out on the twenty-sixth of August. A nest built in a young oak tree in a remote clearing was discovered on August 7th, when it contained a single egg. I did not see the old birds on this occasion and heard but a faint sound, which was evidently a murmur of remonstrance since their nest was promptly forsaken.

I have camped beside five different nests of the Cedar Waxwings, and after having spent more than a week in watching the behavior of both old and young birds at short range, feel that I know by heart most of their nesting habits.

There is a certain routine which is observed by all birds at the nests. Certain duties must be performed over and over, such as the capture of prey, bringing it and distributing it to the young, inspecting and cleaning the household, besides brooding or shielding the young, especially during the early days of life in the nest. To record each visit made and every recurring act performed by the birds would make tedious reading, but strange to say it never seems monotonous to the observer. As the young birds grow older and begin to stand on the rim of the nest they furnish ample excitement, and while their theme is always the same it is delivered with innumerable variations.

The method of controlling the nesting site was first suggested by some Cedar-birds, whose nest of four eggs was in a



Fig. 52. Tantalizing the young. The mother Cedar-bird has come with food, but hesitates to advance and deliver it. Compare with Fig. 50.

thorn-apple bush, and about seven feet from the ground. The main stem supporting the nest was cut off, and fixed firmly in the soil at a height of three to four feet. On returning to the spot two days later I was pleased to find that all had gone well.

After getting the tent up it was not many minutes before a low-murmured *tr-e-e-e-k!* or *ze-e-e-e-t!* was heard, to which the young always responded in a similar strain. Approaching cautiously, with throat loaded to the brim with choke-cherries, the mother bird delivered them one by one, and then inspected and cleaned her household.

After a longer interval the pair came and stood on the edge of the nest. There was nothing in their bills, but their gullets were crammed full of blueberries, and after tantalizing the supplicating young for a moment, up went a head, and presto! out came a berry, which was quickly placed in an open throat, and passed around until it was promptly swallowed. Up went the head again, and the performance was repeated. It was like a magician shaking eggs from a bag, and there seemed to be no limit to its capacity. Many who have witnessed such actions have supposed that the old birds were attempting to distribute the food without partiality to their hungry children, but this is not the case. It is all a question of nervous reaction. The food is not simply placed in the mouth, but pressed well down into the sensitive throat, which promptly responds unless the gullet is already full. The old bird watches the result intently, and if the food is not taken at once it is passed from one to another until a throat with the proper reaction time is found. The movements of the bird are so rapid, and the berry is so often quickly withdrawn, that it is difficult to make an accurate count. Usually from six to eleven blueberries and almost as many choke-cherries are thus carried in the gullet. Wilson, who noticed the distensibility of the gullet of this bird, which will take from twelve to fifteen cedar berries at a time, thought that it served as a crop to prepare the food for digestion. The berries and insects, it is true, often come up crushed to a pulp and reeking with slime, but it is not likely that the œsophagus serves any other purpose than a temporary receptacle for the food.

When the berries had gone the rounds, both birds would suddenly leave the nest with a *whisk*. Again one would hear their murmuring call, *tr-e-e-e-k!* growing more distinct as they

came nearer. Then both would alight on the nest-rim, and stand there a moment like statuettes with heads erect. After regurgitating the food and distributing it, they keenly eye everything in the nest, snap up the excreta from each bird in turn, swallow it, and are off. The young sat or stood on the nest with heads up and all pointed one way. Presently, every black bead-like eye was alert; four scarlet-orange mouths opened at the same moment, and four necks were stretched now to this side, now to that, whence came the least sound. When their parents actually approached with their low-whispered call, they would huddle together and stretch their legs, wings, and whole bodies to the utmost. Then would arise such a chorus of supplicating cries as no parent could resist. Touch but a twig and the nest presents an even livelier spectacle. The young fairly tumble over each other, while their wings, heads, and bodies vibrate with an intensity of desire which their eager voices can only feebly express. Two days ago these young lay quietly in their nest, and when touched showed absolutely no fear, but to-day the instinct of fear had possessed them, and when approached, all hopped off the nest and hid in the grass.

The Cedar-bird will pant with mouth agape when uncomfortably warm, but is never seen to erect the feathers generally, as many birds do in order to keep cool.

While watching this nest, one day in July, I happened to see a Cedar-bird tugging at the frayed ends of a cord which had been fastened to a branch of one of the fir trees, close by our house. Taking the hint, I placed a quantity of red and blue yarn on the branches, and on some bean poles near the nesting site. Every thread was taken from the fir and worked into what became a very gay mansion. It was placed on a spreading apple bough, at a fork in the limb and between upright shoots, fifteen feet from the ground. The blue yarn was in excess of the red, but I am sure that this meant nothing to the birds. They simply took what was provided, and had all been red it would have been accepted.

These birds were most expeditious, for in two days the last

straw was in place, and in six days from the start four eggs had been laid and incubation begun. Ten days later three of these eggs had hatched into young birds, while one was added. Born blind, naked, and helpless, the Cedar-bird begins to see when three days old, through narrow horizontal slits which



Fig. 53. Female Cedar-bird ready to feed young by regurgitation—gullet stuffed with cherries.

gradually open, and expose the eyes to full light. When this nest was touched, the young would raise their tremulous heads aloft, and with red mouths opened wide, express in silence the simple sign language of newly hatched birds. One of the brood mysteriously disappeared, so that eventually only two were raised, and this recalls the loss of a young bird from the first nest which was built by the same pair. When evil befalls

a nestling, the parents either remove its body or abandon the whole family. The latter course is seldom, if ever, followed after the eggs have all been hatched.

At this nest the young gave the call-notes repeatedly, but the old birds usually approached without a sound, and were



Fig. 54. After feeding the young—the gullet empty. Notice the “sitting” posture, and compare curves of throat in Fig. 53.

never both at the nest at the same time. On the second day of observation the mother bird was feeding the young before I could set up the tent. Both birds came frequently, bringing black cherries and grasshoppers. At each feeding the following order of events was usually observed: the parent sounds the call-note at a distance, to which the young reply, but observes strict

silence in drawing near; the young are fed, inspected, and cleaned; the old bird flies to a convenient perch, rubs the bill clean, plumes, and speeds off to the nearest cherry trees.

In the course of the morning these fledglings became very restless, and as the heat from the sun increased, one crawled



Fig. 55. Regurgitating food. Up goes the head, and presto! out comes a berry.

out, sat in the shadow of the leaves, and finally dropped to the grass. Here it was immediately fed, and then hopped away surprisingly fast. The male enticed it along, and thereafter took care of it, while the mother returned to her remaining nestling. Twenty minutes later the last fledgling had left the nest, never to return, and the curtain was immediately rung down. The young had spent exactly two weeks in their tem-

porary home, and had the weather been cooler they might have tarried at least two days longer.

At this age the crest is not very prominent, and instead of the jet-black, triangular band which surrounds the eye in an old bird, the flat crown of the head is encircled by a light band



Fig. 56. She hears a suspicious sound.

passing above the eye. This fillet appears at about the eighth day, and at this age also the tubes of the wing-quills burst, and the red wax-like tips of the secondaries, when present at all, also appear, as was the case with the young from this nest.

When about ready to fly and waiting to be fed the young exhibit the peculiar instinct already noticed of standing erect with upturned heads. A nest of these birds in this attitude

makes a curious picture. Any danger signal is now likely to bring them off in an instant. This particular brood had their abode in a pine tree close to our house. On July 17th, shortly before the picture was made, the family of five was standing bolt upright, all facing one way, as if under military discipline.



Fig. 57. Devouring the excreta: an unusual attitude.

When their branch was touched, all but the two shown in Fig. 142 gained the nearest trees in their first flight and escaped. This pair came to the ground, and were replaced in the nest. In their second attempt, made ten minutes later, the larger of the two birds was more successful. It flew to the roof of the barn, not far above it, and after hopping to the ridge-pole, made the upper branches of a tall elm. In the larger of the

two birds the band of velvety feathers, which traverses the eye, and is jet black in an adult bird, had begun to darken, while the fawn-colored fillet already mentioned was perceptibly reduced, a striking and characteristic change which is usually noticed at the fourteenth day. Compare Figs. 52 and 59.



Fig. 58. Cleaning the nest. When the young are fed, the duty of the old bird is but half done.

That peculiar attitude of the young just described, in which they stand silent and motionless on their nest with heads up-raised, is a form of instinctive behavior which in the adult may be considered in the light of protective mimicry. We have already seen how the timid Cedar-bird, when surprised, will throw up its head and with its bill pointing to the zenith will sit immovable like a statue, in this way simulating a short

upright branch. But the same instinct may be observed at other times when it is even more striking. I once moved a nest of a pair of these birds and mounted it in front of a porch, where it could be easily seen by all the members of my family. While watching the feeding operations one day with a friend, we walked leisurely towards the nest. To our great surprise the old bird did not leave, but stood bolt upright on the main branch, and with head up-turned awaited our coming. She maintained this extraordinary attitude while we stood by at a distance of a few feet and admired the exhibition. It could not be denied that the olive-gray, rod-like body of this bird might under other circumstances, as when surrounded by foliage, have been readily mistaken for a short stub or a truncated branch of the tree.

Another, and in many ways the most interesting, nest was built in a pine, some account of which has already been given, in illustrating the change of the nesting site. I watched these birds over ten hours from the tent, saw a great many interesting sights, and made a long series of pictures.

The young at this nest were visited and fed forty-seven times during an interval of exactly ten hours and forty-seven minutes, on three different days. On the last day they were fed on the average once in ten minutes. The food consisted of choke-cherries and red bird-cherries, varied with raspberries, blackberries, and blueberries, together with insects which, during the last days of life at the nest, constituted about one quarter of the fare. At one half the number of visits recorded, fruit alone was served. From six to ten cherries were brought in the gullet at a time, and once by count eleven blueberries. Feeding was effected almost always by regurgitation in whole or part, and rarely was any food visible when the birds came to the nest. Now and then, however, a bird would approach loaded to the muzzle, with a berry or insect in the bill to round out the measure. Soft fruits like raspberries were crushed to a pulp, and insects, which are commonly served with the berries, came up covered with saliva, and often in an unrecognizable state. The staple animal food was grasshoppers, and I have seen the large cicada

or harvest-fly brought to the nest, but never dragon-flies, butterflies, or moths. The cicada made a lively struggle for a few minutes; it was placed in one open throat after another and withdrawn eight different times, before a gullet was found capable of the proper reaction time. If a bird was slow he lost his chance, and another was tried. The key was at last fitted to the lock, and the bruised and battered cicada was taken in, but the old bird had not finished her task. She began tossing up her head and producing bird-cherries. Then she gave the nest a thorough renovation. In doing this the mother often walks around the rim, and attends to each nestling in succession, sometimes even inspecting one bird more than once.

At first I found it difficult to tell the old birds apart until I noticed a distinguishing mark on the female, who had a little bare spot where the feathers had come out, on the right side in front of the wing. This shows plainly in many of the photographs.



Fig. 59. Young Cedar-bird from nest shown in Figs. 53-58: photographed on the morning of flight, July 19, 1900. The bird was not touched, but occupies a natural perch, chosen by himself.

As I have said in another place, the female would often fly direct to the tent and alight on the end of the ridge-pole just above the nest. Here she would pause a moment, then go to her young. Should they fail to respond promptly, she gives a peculiar clucking sound, a habit common to many species, which is the stimulus applied as a last resort. At this signal every mouth is opened wide, even if the gullet is already full. Indigestible substances pass through the alimentary canal, and are never regurgitated in either young or adults.

Cedar Waxwings have been seen in the act of sipping maple sap in March, either standing near a broken twig and reaching round to pick off the drops from the underside or hovering over the spot and taking sips while on the wing.¹

Towards the last of August, small flocks of Cedar-birds are moving about in search of food, the low murmur of their call-notes being audible for a moment only as they pass overhead. They know when the wild cherries are ripe, and never fail to visit the trees skirting the fields. The black cherry tree is most attractive when laden with the pendent racemes of black cherries, its tremulous foliage shining in the sun, with Robins and Cedar-birds fluttering about it. Every good tree is an aviary when its fruit is ripe in late summer and early autumn. Both old and young are on hand. Then you may see one sidle along a bough, stretch its neck, wag its tail, and fondle another with its bill. Their fine breezy call-notes suggest the bleating of the insects in the grass below. Tent caterpillars spin large nests in these trees, but the birds prefer the acid-bitter fruit to the insects. Occasionally a bird will leave its perch, and dive for an insect in the air with the ease and precision of a professional flycatcher. I have seen the Cedar-bird either taking the spider from his web or possibly robbing him of his prey. The birds peck at the cherries, pull them off, suck up the juicy pulp, but drop the hard stone. The ground under the trees, as well as beneath their favorite perches, is covered with cherry stones. Suddenly there is a swirl of wings, and the band moves off rapidly to try the fruit in some other quarter.

¹ For this note I am indebted to Mr. Robert J. Sim, of Jefferson, Ohio.

CHAPTER VI

VIREOS AWAKE AND ASLEEP

THE moment I touched the spreading branch of a witch-hazel bush out flew a bird, and the next instant my eye rested on the nest of a Red-eyed Vireo. It was suspended between the forks of a twig about six feet from the ground, and was well protected and concealed by the leaves. It then contained two young birds, four or five days old. After examining it carefully I retired, but before doing so fixed a cord to the branch and drew down the nest so that its brim was horizontal, and the whole about four feet from the ground, a convenient height for future study.

The young were quite naked, save for a sprinkling of light down on their heads and backs. They had yellow-rimmed bills, bright yellow throats, and were just beginning to see through the narrow slits, which admit light gradually to the eyes. The old birds betrayed no unusual anxiety, but uttered their unobtrusive *piort! piort!* and the female soon approached with an insect. This nest was surrounded by tall bushes with barely space to pitch the tent in front of it, and as I decided to make no further changes, a spotted leafy background was unavoidable in the pictures. Coming again on July 31st, the tent was soon in place. The female, who was brooding at the time, flew off quickly, but returned in a few moments.

These Vireos soon became quite unaware of being observed, although literally as near the eye as one would hold a book to read. I spent parts of three days on this spot watching a most fascinating panorama of bird-life. On the third day the tent was moved up to within eighteen inches of the nest, but experience has amply proved that the best pictures of the nesting

scenes, in which the objects are usually in rapid motion, cannot be obtained at such close range.

On the first day it required forty minutes to restore perfect confidence, before the affairs of the nest were conducted with their usual regularity. The young raised their heads aloft and called loudly for attention, or hung drowsily over the brim of the nest. At this time their skin was dotted with the fine rapidly growing feathers, and the wing-quills looked like slender paint brushes, having just burst the tips of the cylindrical horny tubes in which they grow.

The old birds examined the situation carefully. Their mournful *piort! piort!* was heard again and again, the male answering his mate as she deliberately approached the nest. After advancing many times, and turning back as often through fear or distrust, the mother hopped up briskly with a bee in her beak. Her instinct to care for her young was stronger than the male's, and she almost invariably approached in the same way, by the path of the twig in the fork of which hung the nest. A smaller division in the fork gave off a still smaller branch close to the nest, and upon this the birds always perched, and thus stood directly over their brood. Any vibration of the nest, as when the feet of the old bird touched the main stem to which it was fixed, or any sound above or below, electrified the young, and up popped their heads like two jacks in a box. With mouths wide agape, they would clamor and quaver, expressing their emotions not only by the vibration of the wings but by the shaking of the whole body. But the young at this tender age are unable to discriminate with any exactness. The quivering of a leaf, or the stirring of a twig close at hand, a puff of wind, the flutter of a wing or the voice of any passing bird would throw them into the same state of excitement. But this was only for a moment. Their heads would again drop listlessly over the wall of the nest, and with open mouths they would doze in the sunshine. Something would then suddenly arouse them, when they would instinctively go to preening themselves just like old birds, although they had at this time no feathers which needed this attention.

Quite often you would hear a *huic! huic!* which always aroused the young, who would *tsip!* back in earnest. While the mother was again coming slowly towards the nest with a bee in her mouth, another bee happened to cross her path. She darted after it, but missed her aim. Then, disposing of the first insect, she



Fig. 60. Female Red-eyed Vireo and young interlocked in the feeding process, showing the depth to which food is inserted in the throat. Photographed from an elevated tent with white screen at back,—illustrated in Fig. 42.

watched her young intently for a moment, stooped, picked up a small white package, and hurried away.

At one o'clock the old birds took a midday rest, and it was full twenty minutes before that reassuring *piort! piort!* was heard. Then as, step by step, the mother came nearer the magnet, the drawing power of which was irresistible, her livelier *huic! huic!* awoke the young, who started and replied *swit! swit!* Thereupon the old bird quickly hopped along the branch, straddled the fork, and tucked a large grasshopper into one o'

the open mouths. In three minutes she was back with another, this time stopping to clean the nest again. Five minutes by the watch had passed when she returned with a brown-gray-winged insect over an inch long, which an entomologist might be able to name from the photograph. She paused for a moment while the young called eagerly and stretched their necks to the utmost; then she helped the insect down the throat of the lucky bird. However, it stuck at the gullet, and the little one gulped hard before its protruding wings had disappeared.



Fig. 61. Female Red-eyed Vireo ready to deliver a large insect. Photographed against natural background. Compare Fig. 60.

As is well known, the young bird has wonderful powers of digestion and assimilation, and after the first week the rapidity of its development becomes even more striking. A lapse of twenty-four hours now means a great stride in growth. It takes food almost constantly throughout the day, and digests it quickly, though imperfectly. The adult Vireo, like the Flycatcher, is known to regurgitate the indigestible parts of its food in pellets.

The male Vireo seldom came with food, and then always with an extra degree of caution. Twice he followed swiftly after his

mate, acting as her guardian while she quickly went the rounds. The rôle of the old birds in feeding was almost invariably the same, as I have in part described. They trace a zigzag line to the nest, a straight one from it. You hear first their responsive call-notes. The mother bird with insect ready is in a bush a rod away; then she comes a step nearer, and pauses; her *piort!* is now more distinct. She slowly advances, until the twig which holds the nest is touched. Up go the heads of the young; they call aloud, stretch their necks to every side, gaze up to the



Fig. 62. Placing it well down in a hungry throat.

clouds and around upon the leaves. Then, as the mother hops nimbly along the twig, and stands over them, what a picture of eager desire, tremulous impatience, and keen rivalry they present! The food is sometimes quickly placed in the throat of one, and as quickly withdrawn, to be given to another, and when there are more than two it may go the rounds before it is allowed to remain, a common practice the true meaning of which we have already seen.

After inspection is completed and the nest cleaned, the parent bird flies to any convenient spot, carefully wipes the slime from her bill, stretches her wings, and smoothes out all

the ruffles in her dress. These birds always look as sleek as a new silk hat, every feather lying smooth in its place.

One day while in my tent, a small bird of another species suddenly darted down upon this nest. There was a momentary flutter, a clash of beaks and claws, and the intruder was promptly driven away.

It was always interesting to watch the behavior of the young between the intervals of feeding. The moisture would fairly glisten in their wide-open mouths. They snapped at every ant and flying insect which came within their reach, but



Fig. 63. Standing in characteristic prone attitude of inspection.

I never saw a single capture. The preying instinct is undoubtedly one of the most ancient among animals, and young birds peck instinctively at all kinds of small objects, but precision of aim which leads to success in capturing their prey must be acquired by practice. These young Vireos would often hang their heads down over the nest, and doze until aroused by the piping of the Robin, or by the call of some other bird. Then the mother would appear, with a huge green katydid, its wings crumpled and held tightly in her sharp bill. It was surprising how quickly and gently it was assisted down one of the hungry throats.

At one of his visits, the male, after cleaning the nest and

young with great care, stepped in and began to brood, when two downy heads popped up from under his breast. He showed unmistakable signs of discomfort and uneasiness, repeatedly erecting and lowering his crest, and puffing out his throat. With mouth wide open he gazed keenly about him, and after a few moments dashed off as if in pursuit of an enemy.

When a large grasshopper which had been given to a young bird had made good its escape, the mother darted after it, seized it before it had touched the ground, and you may be sure that there was no possibility of escape this time. A grasshopper was sometimes divided between the two young, but



Fig. 64. Drawing back through timidity.

usually a single bird only was fed at a time. The male warbled his pleasant strains from a branch hard by, while the mother hunted for insects in the grass below. A large brown locust with yellow and black wings was soon brought in. The adult Vireos glean most of their animal food from the foliage and, as might be expected, are great caterpillar destroyers, but while feeding their young I frequently saw them exploring the grass as any Robin or Song Sparrow might do, snapping up every insect which came in their path.

On the third day, when my tent was but eighteen inches from the nest, the old birds came to it even more readily than before. They would still occasionally start at the click of the shutter, but they did not mind the shrill scream of a locomotive across the river, or the rumble and splash of logs which were momentarily being set free and sent tumbling headlong down a steep slide into the river below. They had become used to these sounds and had learned from experience that they were harmless. On this day, a great change seemed to have come over the young. They had become almost transformed in appearance, and were very restless. Their bodies were now well covered with feathers, and they were beginning to show the first traces of fear. Their snow-white breasts gleamed through the thin walls of their cup-shaped nest, or from over its rim. Grasshoppers, katydids, green larvæ, beetles, and bugs of many kinds were served again and again, but it would be a mistake to suppose that there was no fruit to vary this diet. Upon the third day the mother brought a ripe red raspberry, its juice fairly streaming down her bill, and after a few beetles had been taken she appeared with a large blackberry. Fruit was served to the young about half a dozen times in the course of four hours during which watch was kept on this particular day, but I had not seen a single berry brought to the young before this time.

On the first two days of observation the young were fed on the average of once in fifteen minutes, but upon the third day food was brought every nine minutes.

Hitherto I had taken pains not to touch the nest, but as I approached for a final look at the young at about two o'clock they immediately took alarm, and popped out one at a time. The larger of the two disappeared, and was never seen again by me, and although I replaced the smaller bird in its nest time after time, it positively refused to stay. Like the young of so many wild birds, when once they have tasted the freedom of the world they seem to look with disdain upon their old home. Although these birds could only flutter in their first attempts at flight, they could hop nimbly from branch to branch, and thus ascend readily to the tops of high bushes.

Upon visiting the site of this nest on the following day, one of the young birds was discovered in the grass less than two rods from its empty nest. It was calling loudly for food, and the old birds were tending it. A few hours later I returned in the nick of time to save its life by the capture of a large garter snake, which in some way had discovered its opportunity.



Fig. 65. Young Red-eyed Vireos, shown in Fig. 64, leaving the nest. No. 14 of table, Chapter I.

Another Red-eyed Vireo's nest was detected by the sharp eyes of a little girl beside our house, and close to a well-trodden path. It was suspended to a forked twig of the sugar maple, and in order to disturb it as little as possible the tent was mounted on a raised platform five feet from the ground, while a tall photographic screen was erected at the back (Fig. 42).

When the young Vireos were a week old I began to watch their nesting habits at night more closely, and found that, while the male apparently roosted near by, the female invariably

slept on the nest. At from fifteen to twenty minutes after sundown she was regularly at her post, and even at this hour usually fast asleep. So profound, indeed, were her slumbers, that I could often enclose her in my hand and stroke her feathers without awaking her. She slept with her head twisted back and buried deep in the feathers between the shoulders. An apparently headless trunk or a little ball of feathers was all that could be seen, and the only motion discernible came from the regular pulsations of breathing.

In this manner the mother apparently passed the night, unless disturbed. When aroused by a ruder movement of the hand, she would peck feebly at a raised finger, but if not molested the eyes would gradually close, and the heavy head turning slowly on its axis settle down on the soft cushion again. If actually driven off she would return in a second, and in another moment would be fast asleep.

On a quiet evening, just after sundown, the camera was set on the platform, and two photographs were made of this sleeping bird without awaking her. In the first the plate was exposed for five and in the second for twenty minutes (Fig. 66), both yielding good prints, allowing for the regular movements of respiration.

The sleeping habits of birds do not appear to have received much attention, and are often difficult to observe. That they vary not only in different species but with the season and other conditions is obvious. When not breeding, many of the smaller perching birds seek the dense coverts or foliage, which afford protection from cold as well as from enemies. Grouse are sometimes found enclosed in light snow; Quail hover in dense covies on the ground, where they pass the night; birds of prey, like Hawks and Eagles, sleep at odd intervals by day or night, with the head buried in the feathers of the back. The diurnal sleep of Owls and Goatsuckers is more readily observed. The male Robin has been known to pass the night at a long distance from its nest. In a community of Great Herring Gulls, which knows no repose by day or night, the old birds take frequent naps at all hours, and either while on the perch or the nest.

This Gull will occasionally doze with head drawn in and eyes closed, but usually conceals its head in its feathers like a Hawk or Vireo. But if at such times the Gull is dull of sight its hearing is keen, for at an alarm it will suddenly throw up its head and with outstretched neck scream loud enough to be



Fig. 66. Female Red-eyed Vireo, asleep on nest. Photographed after sundown, with an exposure of twenty minutes, July 5, 1902, 7:10—7:30 P. M. The head of the bird is twisted to the left side—the bill pointing to the right of the picture—and is buried up to the eyes in the feathers of the back.

heard for half a mile. Some of the Pheasants sleep with the head either drawn in on shortened neck, or turned back and concealed. In calm seas Duck and other water-fowl often sleep when afloat. So far as I have observed, the same bird always turns its head to the same side in sleep, and this seems to follow as a matter of course from the force of habit.

The snow and storms of winter usually knock the bottom out of the Vireos' pendent nests, but some remain whole for over a year. Wilson speaks of finding the nest of the Yellow Warbler built inside of an old Vireo's nest. The deer mouse sometimes takes possession of an abandoned nest in fall, and converts it into a snug globular house for itself and young. I remember the feeling of astonishment which the discovery of one of these converted nests gave me when a boy at school, and of wondering to what animal those black lustrous eyes, which appeared at the entrance, could belong. In this case the original framework was concealed by a symmetrical dome of thistle-down, a substance used also in lining and covering the original walls. There was a small round hole or side entrance, just above the old rim. When disturbed, this sleek little mouse left its warm house, ran down the branch, and disappeared.

CHAPTER VII

THE NEST-HOLE OF THE BLUEBIRD

THE mellow note of the Bluebird is a welcome sound on March mornings when the air is yet wintry, and the snow stands deep in the woods. Its meaning is unmistakable, but to appreciate it, one must live in the North where spring means literally "turning over a new leaf," a new order of existence. Should cold weather or heavy snows return, the birds retire for a time, but promptly reappear with better days.

The males are first to arrive, coming singly or in small straggling companies. As we walk along the desolate country roads, they rise from wall and fence-row, displaying their brilliant azure wings, or when flying overhead the cinnamon brown and white of their under plumage. Their almost ventriloquial *phoe-ur* note which is heard as they fly is not peculiar to any season.

When the females come a little later, the males are in full



Fig. 67. Female Bluebird taking a look outside, as if hesitating before going in search of food.

song, and the period of courtship, which is very ardent in the Bluebird, begins. The affection and gallantry of the Bluebird have aroused the enthusiasm of many observers. Unfortunately, we are obliged to add that a case of polygamy in this species has been reported.¹

The choice of a nesting site is made with great care and deliberation. If they accept the house or box prepared for them, they often have to defend it against the Wren, the Martin, and the House Sparrow. Wrens and Martins are easily driven off, but the pugnacity of the Sparrow and the greater numbers which he can usually muster render resistance hopeless. An abandoned Woodpecker's hole is not disdained, since it forms a safe, cozy house which needs little furnishing. This snug cavern is sheltered from sun and rain, and secure from most birds and beasts of prey. The rotten fence-post and the many holes in the decayed apple trees may also contain the secret of the Bluebird's nest.

On August 11, 1899, I saw a pair of Bluebirds paying marked attentions to an old "auger-hole" in an apple tree, made by Golden-winged Woodpeckers. It was plainly a case of nest within nest. The female was carrying insects to her invisible young, which I supposed at this late day were ready to fly, but, as it afterwards appeared, they were only five days old. This hole had been nicely drilled beneath the springing branch of a truncated and now dead prong of the tree, fifteen feet from the ground.

When an opportunity was offered on August 15th, I sawed off the limb, two feet from the opening, and set it up in a convenient spot fifty feet away. It was so arranged that the whole trunk could be rotated, and the circular entrance of this nest turned directly to the sun at any time of day. I had barely left the place to fetch the tent when the mother bird flew from the apple tree to the stump, entered the hole, and having fed the young, came out with a small white parcel in her bill. This bird had her eye on the nest, and was ready to visit it in its new situation, when free to do so. The tent was placed two feet

¹ *Bulletin Nuttall Ornithological Club*, vol. viii., p. 63.

away, but later drawn up to a distance of about eighteen inches. After concluding these operations, I had to wait longer for the parent bird to come again. When one considers that the nest-



Fig. 68. Female Bluebird carrying grasshopper to young.

ing branch was suddenly moved fifty feet from its original position and fixed on the ground, and that a tent was then pitched so close to it that the birds could not fly straight to the entrance but had to flit first to the trunk and then go around

to the hole, it is not surprising that they held aloof. I waited exactly one hour and twenty-five minutes before the mother again brought food to her young. Meanwhile it was interesting to see what was happening, from a peep-hole of the tent. Both birds would fly to the tree which they had known as their home, and mechanically go through their usual motions in approaching the nest, hopping first to this branch, then to that, following a well-defined path, which they had traveled hundreds of times; and finally hover over the spot which was once occupied by the nest, as if to become assured that their eyes had not deceived them.

These actions, which afford an excellent illustration of the force of habit, were repeated by both Bluebirds many times, while they uttered their responsive *phee-ur* note. Again, calling eagerly, both would fly towards the new position of the nest. Finally, the female, who in this case assumed the whole task of feeding the brood, came to the stump, paused a moment, quickly entered the hole, and came out in hot haste. The absolute stillness, however, had restored confidence, for in five minutes she returned with a huge green grasshopper and in ten minutes was back again with another. In the course of each visit the plaintive call would announce her presence as she approached with insect in bill, and alighted on a half-dead peach tree close by. After a momentary survey of the situation she would flit to the stump, sit for a few seconds on a dead branch at one side, then hop down, fly to the hole, and catch on the bark or cling to the rough edge of the circular opening with her sharp claws, pausing there a tenth of a second, or long enough to cast a swift glance backwards. In this position she was photographed many times, with grasshoppers, crickets, green larvæ, katydids, and once with a large robber fly in her beak, the profile of her head being sharply vignetted by the dark circular entrance. The young must have been all a-quaver at the sound of their mother's wings, for the old stump seemed to become suddenly alive with brisk chirping sounds the moment she touched any part of it. The bird used her tail to help support her weight against the side of the tree, like a Woodpecker,

and I noticed that the tail feathers were frayed and worn at the points.

The male during the numerous visits which followed came two or three times and sat above the door, but never actually entered it, and never brought to the young a single morsel of food in the course of the entire day. He would warble very sweetly, however, and probably encouraged the exertions of his mate. The next time this bird appeared with a grasshopper she did not trust herself inside, but stood at the entrance, put her head in and as quickly drew back to take another glance around, then leaned far down and fed her clamoring brood. At this moment a flock of Goldfinches flew overhead, and were heard calling *be-be! be-be!* at which the young Bluebirds were instantly aroused, and made the old stump resound again with their cries. After many grasshoppers and



Fig. 69-71. Bluebird engaged in nest-cleaning, representing three visits, at each of which food is served. Nearly one half life-size.

crickets had been dispatched, another *Asilus*, the hairy robber fly, already mentioned, was brought in. Then another bright green katydid, with its wings half spread in its vain effort to get free, was served to the young. If frightened in an attempt to enter the nest



Fig. 72. Standing at entrance with large grasshopper in bill.

this bird invariably returned shortly, and after the feeding was over, would take the excreta, and fly some distance before dropping it. In no case was it known to be eaten at the nest. During the afternoon, when these birds had become more at ease in their new surroundings, the nest was cleaned six times in two hours. I saw this bird bring to her young no less than twenty grasshoppers, four cone-headed katydids, two black crickets, besides larvæ and many small insects. During the forenoon, in the

space of nearly three hours, the young were fed on the average of once in six minutes, and for two hours in the afternoon once in nine and a half minutes.

The Bluebird is one of the most unobtrusive of our wild birds. It goes about its business quietly, and seems never to fight except in defence of its home, but we must not be surprised to find that individuality can assert itself even in the Bluebird. In the case just described the female led the way, while the male was extremely timid. At another nest, on the contrary, the conditions were quite the reverse. Not only was the male always first in bringing food, but his pugnacity reached an unexpected pitch in a bird whose gentle and confiding manners have been praised by many enthusiasts. This nest was boldly defended when the stump was moved, and for more than a week thereafter the male fiercely assailed every person who ventured upon his domain. With the speed of an arrow, and with angry snapping of the bill, he would dart straight at the intruder, who involuntarily ducked his head, and felt no desire to repeat the experiment. This bird would also dart at the tent, and at the observer the moment he showed himself outside. In short he was constantly at the nest, which he defended most admirably, and was unrelenting in the task of providing for his family.

According to one authority, there are usually three broods, and before the first set of young can shift for themselves the female repairs the nest and gets ready for the second. The male continues to care for the first brood after the second has appeared, will feed his mate, and even take her place at the nest.

CHAPTER VIII

MINUTE OBSERVATIONS ON CATBIRDS

WHILE the Catbird has a strong attachment for its young, especially during later days of life at the nest, when any intrusion will arouse its fighting instinct to the highest pitch, it is under ordinary conditions exceedingly wary, suspicious, and hard to approach. In the account which follows I shall describe only what was seen while camping beside two nests of these birds.

The first of these attractive nests rested on a spray of the sweet viburnum, in a little clearing in dense bushes, and about four feet from the ground, so that no change in its position was necessary. It contained a single addled egg and two young with the feather-shafts of the wings barely exposed.

For an hour or more after the tent was in position, the old birds kept up a perpetual din, in which their exasperating *tschaying* note was most pronounced. They would circle round and round the tent, often coming close as if to discover the way in, or fluttering and screaming at it, as if it were a demon to be exorcised. After this they gradually became more quiet, and began to alight on the tent's guys and roof. At last the female was seen stealthily to approach and quickly feed her young. After a fresh reconnaissance both birds went to the nest together and with rapid, jerky movements stuffed red cherries into the hungry throats, inspected and cleaned each young bird, and then darted away.

While in a state of mind wavering between fear and assurance, the Catbird passes rapidly to a branch, and spreading and pumping the tail, pauses in an attitude of attention before making another movement.

Both birds now began to bring an abundance of insects and fruit, as if making up for lost time. The female came with



Fig. 73. Female Catbird bringing in a large limp dragon-fly—the *Æschna heros*.

two cherries in her bill and promptly gave one to each of the birds. Then a grasshopper was served, and still again a dragon-fly, with blue body and spotted wings (the *Libellula pulchella*).

The insect was swallowed, wings and all, but only after prolonged efforts. As confidence was gradually regained, the birds would remain longer and longer at the nest, pick the young all over, and clean everything with care and deliberation.

At this time (July 23d) the young were about eight days old, and could be easily approached. Two days later, when their nest was touched they tumbled out in an instant, disappearing as if by magic amid the leaves. I succeeded in finding one of them, but it refused to remain in the old nest. Its wing-quills now showed a half inch of the feather-shaft, which represented two days' growth, while the tail feathers were still in the stub-brush stage.

There were four young in the second nest, which was discovered in some bushes close to the river bank on the nineteenth of June. It rested in the crotch formed by the crossing of shoots of the dogwood and alder. The young were in pin-feathers, but not a tube had burst. Both old birds happened to be off foraging, but quickly returned with food in their mouths, and began to alarm the neighborhood.

The tent was pitched in front of this nest at eight o'clock on the morning of June 23d. After it was closed both birds began their cautious explorations in the vicinity, *tschaying* incessantly and with nerve-rasping vehemence. A male Redwing Blackbird was soon attracted to the spot, and added his note of alarm to the general outcry, but after finding that the matter did not concern him, returned to his nest in the flags farther away.

In twenty minutes the Catbirds had become more quiet, and began to pay close attention to the tent. The Redwing was heard *con-quer-eeing* in the distance. Song Sparrows were singing merrily. Veeries called from the woods close at hand, and the *be-be!* of the Goldfinches could be heard as these birds passed leisurely overhead. The conditions were all reassuring, and presently the Catbirds became silent, and went off for food. In a few moments a rustling of leaves was heard close to the tent and the male could be seen coming boldly in its direction.

Up to this time the young lay quietly in the nest, but were

alert to every sound whether from the wind or any passing bird. Their wing-quills had become exposed in the course of two days to a length of three quarters of an inch.



Fig. 74. Female Catbird inspecting after having fed the young.

Suddenly a jubilant song burst from the throat of the male, and his mate thus encouraged approached the nest with insect in bill, but her fears were not allayed, for after beating

about she swallowed the insect herself and went in search of another.

The young now began to yip in earnest and to stretch their scantily feathered transparent necks. One of the lustiest of the four even climbed to the edge and sat in the shade. They would erect their scanty crest-feathers and pant in the sun, which, though not excessively hot, was, with the added feeling of hunger, beginning to make them restless.

The sense of fear was at last overcome in the mother, who came, fed and cleaned the young, and flew off again. After another pause a huge dragon-fly was brought to the nest. The observer had to wait long at the beginning, but his reward was now quick in coming. The young were then fed every five or six minutes, but the male rarely went to the nest himself. Still cautious to a degree, he would follow after the female, but stop a few feet short of the nest. Then after delivering her insect she would go at once to her mate, take the food from his bill, and bear it to the young.

The following table gives the number of visits at which food was brought during eight consecutive hours from 8 A.M. to 4 P.M., and illustrates how the parental instincts, aided by habit, gradually overcome the feeling of fear in a very shy and suspicious animal.

HOUR.	NO. OF TIMES YOUNG ARE FED.	NEST CLEANED.	REMARKS.
1 }			
2 }	1	1	Young fed by female.
3	1	..	" " " "
4	5	1	" " " "
5	8	2	Young fed once by male.
6	10	1	Young fed twice by male, who also brings food which female delivers.
7	11	3	Old birds begin coming to nest together.
8	17	4	Young fed twice by male, who also brings food for female to serve.

Five times in rapid succession the mother brought in dragonflies of extraordinary size (the large *Æschna heros*), of a light



Fig. 75. Female Catbird cleaning the nest.

greenish-yellow color, and limp as wet paper, having just issued from their pupa cases. This bird presented an interesting sight as she approached with one of these long insects hanging from her bill, for she always held them by the head. The

dragon-fly was as long as the young bird, but it was invariably swallowed wings and all, though only after a hard struggle.

The young, always on the alert, huddle to this and that side of the nest, and stretching to the utmost limit their transparent red necks display the yellow target of the open mouth as they *tsit! tsit!* to the approaching mother, who sounds her well-known call.

On one occasion I saw the female deliver a black dragon-fly, and afterwards take from the bill of the male, who was standing near, a carrion beetle, and pass it to the young. Then keenly eying her brood, she deliberately bent over, and as the body of one was raised took from it a small white package and flew away. Many of the photographs show the birds performing this sanitary act, a practice common to many other species. During her first visits the female ate the excreta, but thereafter it was invariably removed from the nest.

The food served to these young Catbirds consisted of dragon-flies, which were brought to the nest thirteen times, insect larvæ, beetles, moth millers, and a great variety of smaller insects, varied with liberal courses of strawberries. At first the old birds approached quietly, fed their young hurriedly from the farther side, and were off in a few seconds, but as confidence in their surroundings was gradually restored, they would come to the nest-front, with the camera but three feet away, remain there for a full minute, and after assisting the young to dispose of their harder subjects, inspect everything with the greatest care.

When this nest was visited two days later the young looked bright and hearty. They were now in full feather, and about ready for flight. When the tent had been cautiously set up, I noticed that a number of leaves cast undesirable shadows on the nest. Though knowing well what to expect, I decided to take the risk, and reached out to cut them off. This was the fatal spark which fired the train of gunpowder, for all went off in an instant in a panic of fear, and the game was up, for Catbirds when well out of their nest at this stage are out for good.

CHAPTER IX

THE REARING OF THE NIGHT HAWK

IN crossing a clearing one day in June I flushed a Night Hawk, who showed by her behavior that the little depression from which she rose contained something of great interest to both



Fig. 76. Night Hawk and eggshells from which it emerged. Three days old, June 27, 1900.

the bird and myself. She was indeed incubating a single marbled gray egg, which lay on a marbled gray patch of earth still covered with ashes and cinder. The bird retired quietly, dropping with a thud to the ground a few feet away.

Two days later, if my estimate is correct, a young Night Hawk cracked his shell neatly in two and emerged to the light of day. When first seen on the twenty-sixth of June he was well clothed in down, and looked like a little flattened ball of

fluffy worsted, of a dark cream color mottled with brown, colors which harmonize well with the usual tints of the soil. You had to look a second time to detect the stub of a beak at the base of



Fig. 77. Young Night Hawk in enclosure on spot where it was born, and where it remained until able to fly when eighteen days old.

which the large round nostrils were sufficiently prominent. Whenever this bird was aroused from its all-day slumbers the eyelids would gradually open and disclose a pair of large, soft, deep blue eyes, the lower lids showing decided angular contours which became more striking as the bird grew.

The mother brooded during the heat of the day or sat as if dozing beside her charge. When surprised at such times she rose and with feathers erect and tail spread fluttered off in a slow shambling manner as if to encourage pursuit. With her feathers raised and her huge mouth wide open, or the mandible vibrating up and down with an audible snapping sound, as if set on springs, this bird presented a curious appearance, recalling

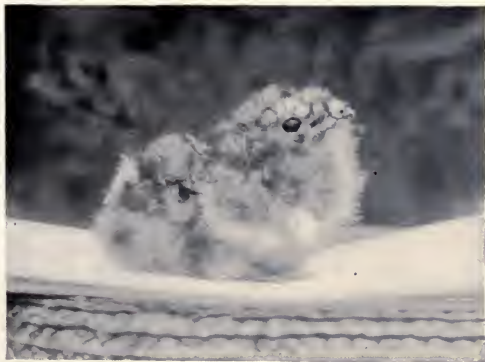


Fig. 78. Night Hawk three days old. Nearly life-size.



Fig. 79. Night Hawk nine days old, July 3d. Length in sitting posture, $3\frac{1}{2}$ inches.

the not wholly dissimilar behavior which Eagles display when stirred by similar emotions. When the young Night Hawk is exposed to a hot sun, its lower jaw also begins to vibrate but at a much higher rate of speed, when it will toddle off and crouch in the shade of a leaf. It begins to walk when three or four days old, but rarely emits a sound, except under circumstances which will be presently described. Fearing lest the old bird should entice it away, I corralled it in a small enclosure of wattled twigs on July 3d. In this pen it remained a week longer or until able to fly, at the age of about eighteen days.

Wishing to witness the feeding habits of these birds, which I believe have never been described, I spent parts of three days and nights camped beside the enclosure and was the witness of some interesting and curious sights. On the first day I set up the tent at three o'clock in the afternoon, but heard no sound for an hour, when the young began to *pe-up*! At five o'clock the *pisk*! of the male sounded for the first time. During the interval a single incident occurred to vary the monotony. A green snake in the course of his rambles had discovered the young Night Hawk, and when first seen was watching the bird intently from a stump close to the tent. The snake after remaining with head erect, and keenly eying the bird for a long time, slowly advanced, putting out his tongue, but when a few inches away hesitated again, and as if deciding not to experiment further, turned to one side and disappeared. The bird paid no attention whatever to these advances of the snake. At this juncture I left the tent for an hour, and returned as the sun was setting at half-past seven o'clock.

At dark a change begins to come over the Night Hawk family. The young bird shows signs of life, moves about calling for food, and grows livelier as the darkness increases, making a sound like *pe-ur*! *pe-up*! Both old birds are now alert and gyrating overhead. You hear their *pisk*! *pisk*! and the startling sound caused by the vibration of the wings, as an old bird descends like a bolt toward the earth. As these sounds increase with their nearer approach, the nervous excitement of the young is curious to behold. He is all a-tremor, moves now in



Fig. 80. Night Hawk twelve days old, July 6th.



Fig. 81. Night Hawk sixteen days old, July 10th. Length in sitting posture, $4\frac{1}{2}$ inches.

one direction, now in another, and his *pe-ur*-note reaches a pitch unknown before. Presently you hear a thud as if a clod of earth had dropped. Then the mother bird, crawling over the leaves, begins calling *ke-ark! ke-ark!* This sound, however uncouth to the human ear, corresponds to the *cluck!* of the hen to her chicks, and awakens an immediate response in the young Night Hawk. He does his best to go to his mother, but the



Fig. 82. The Night Hawk builds no nest, but lays its eggs on the bare ground or rocks.

obstacles being insurmountable, she comes to him. She is loaded with fire-flies,¹ and as her great mouth opens you behold the wide jaws and throat brilliantly illuminated like a spacious apartment all aglow with electricity. With wings erect and full-spread the old bird approached to within fifteen in-

ches of my hand, making an electric display at every utterance of her harsh *ke-ark!* Then standing over her young, with raised and quivering wings, she put her bill well down into his throat and pumped him full. His down-covered wings were also spread and a-quiver. In this position they remained interlocked and silent for one or two minutes. When the feeding was over she tucked the little one under her breast and began to brood. It was not long before she was off again in the darkness, and upon returning the performance was repeated, after which she settled down to brood as if for the night. This young bird was fed but twice each evening between the hours of eight and nine o'clock, and always, as I believe, by the female. It is probable that another feeding time also occurs at dawn. During the

¹ Undoubtedly the little beetle *Photinus pyralis*.

earlier hours the male would sometimes swoop down with terrific wing-blast as if to drive away intruders, and he once came and sat by his chick for ten minutes after dusk without causing any excitement. The task of feeding was borne by the mother, and her presence never failed to excite the young.

I tried to make a flash-light picture of the old and young bird interlocked in the feeding process, and could easily have succeeded had my lamp been of a kind which showed no light before the flash.

In two weeks the mottled down of the Night Hawk chick has given place to mottled feathers, in which the tints range from dark to light brown or buff. The wing-quills are almost black with buff edges. The fifth quill or primary has a pure white transverse spot near the point of emergence from the feather-tube, the first trace of what becomes a conspicuous mark on the wings of an adult bird. The fledgling is more lively in the daytime, runs about easily, will utter his *pe-ur*-note, and can fly short distances.

CHAPTER X

THE KINGFISHERS AND THEIR KING ROW

THE Kingfisher has a strong attachment for particular nesting places, and will occupy the same bank for years, if unmolested, and sometimes even when robbed. The Belted Kingfisher, though widely distributed, seems to be nowhere very abundant. In New Hampshire one rarely finds more than a single pair nesting in the neighborhood of any village or town.

The nest now to be described was drilled into a sand bank beside a country road. It had a straight four-inch bore, which four feet from the opening expanded into a low-vaulted chamber six inches high and ten inches across. When this dark subterranean abode was opened at the rear, on the nineteenth day of July, 1900, I put in my hand and drew forth in succession five very strange-looking creatures. They had huge conical bills, short legs, and fat squatty bodies, which bristled all over with steel-gray "quills," the feather-tubes, which had not yet burst, suggesting an antediluvian monster or reptilian bird on a reduced scale.

These five young Kingfishers which were then about nine days old had already acquired some curious habits. They, like the adult birds, stand not on the toes simply, but on the whole tarsus, which corresponds to the scaly part of the leg of a fowl, so that the "drum-stick" rises from the heel. They can be posed in any position like toy soldiers, but if placed in line they will soon break ranks and walk backwards, even moving up inclined planes or against obstacles set in their paths. They are rarely seen to take a single forward step for many days after reaching this stage.



Fig. 83. Kingfisher entering bank with fish. July 23, 1900.



Fig. 84. Kingfisher backing out of tunnel. The sand streams from the opening at every entrance and exit.

The human infant and vertebrated animals generally instinctively walk forward; how then does it happen that the young Kingfisher early acquires the grotesque habit of walking backwards? The anomaly is readily understood. From the time of birth the young lie huddled in a cluster in their dark underground chamber, which opens to the outside by means of a single narrow tunnel. As they grow in size and strength the monotony of sitting still, often with legs and wings interlocked, must become very great, and whether for diversion or not, at all events they soon begin to bite and tease one another like young puppies. Should one be hard-pressed, the only way of escape lies along the narrow passage, which they naturally traverse head first; but the instinct to return to the warm family cluster is strong, and to do this they are obliged to walk backwards. Again when the rattle of the *alma mater* announcing the capture of another fish is heard, each struggles to get down the narrow passage-way first, but when the parent enters the hole she hustles them all back. With each backward movement the young Kingfishers thus come to associate pleasant things,—food and warmth. Thus the habit is temporarily fixed.

Wishing to see these birds take fish to their young, I decided to try the tent, although it was impossible to get nearer than eight feet, and the hole was in full light for only a part of the forenoon; besides, being situated on a roadside, one was in constant danger of interruption. The experiment succeeded, however, even better than I had anticipated; ten visits were recorded, and the old birds were photographed in the act of both entering and leaving their tunnel. They brought a single fish each time, usually what appeared to be a small chub or dace, and I once recognized a good-sized sunfish.

When the tent and camera were ready at nine o'clock on the morning of July 23d, the parent birds were away on a fishing excursion, and did not return for half an hour. At last a series of warning rattles, at first faint, but momentarily becoming more shrill, announced the approaching bird, who came at full tilt with fish in bill. Hesitating at sight of the tent she perched

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on the dead limb of a pine, flew to and fro from one side of the road to the other, and made the woods resound as never before. Even



Fig. 85. Five Kingfishers from chamber at end of tunnel ; nine days old. July 19, 1900.



Fig. 86. Posed in line,—biting, pulling, and crowding one another.

the depths of the earth seemed to respond, as the muffled rattles of the five young Kingfishers issued from their subterranean

abode. From whatever point of view we regard this singular note, it certainly carries well and is admirably adapted to arouse the fish under water and the young bird under ground.

When the wriggling fish nearly slipped from her grasp, the bird would shift it about until her forceps had a firmer grip at a point just back of its head. At every reel of the rattle, each of which seemed more shrill and more impatient than the last, she would start as if to go to her nest a few yards away. Occasionally a peculiar creaking sound escaped her, suggesting the grating of dead limbs when swayed by the wind. Suddenly with rattle in shrillest *crescendo* she bolted straight into the hole, delivered the fish, remained for half a minute, then came out backwards, turning in the air as she dropped from the entrance, and with a parting rattle was off to the river. During these visits the Kingfishers usually remained but a quarter or half a minute in the tunnel, and always came out backwards, except on one occasion when I saw the bird turn near the entrance, and shoot out head first. The longest visit recorded lasted three and a half minutes. When a youngster was encountered near the mouth of the tunnel he was driven back to the chamber, where the food was distributed. Once only did I see an old bird pause at the entrance for a hasty glance backward, and thus give a good profile view of head with fish in bill. Unfortunately the plate had already been exposed, and before it could be changed the opportunity was lost. The old birds, however, must have often turned about at the entrance on both entering and leaving the hole, as shown by the deep furrows plowed by the bill at either side of the opening.

When the young are ten days old, the feather-tubes have begun to burst at the tips, and their horny substance is gradually shed in the form of powdery scales. The feathers grow slowly, but at the age of two weeks the characteristic colors of the adult are becoming apparent,—the slaty-blue of the upper parts, and the white of the breast which is traversed by a bluish-brown belt, with rusty brown along the sides. As they rattle when taken from the nest their whole body quavers. They will hiss, bite one another, huddle together, and erect their crests of long

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stiff feathers. They attain to full plumage or nearly so when three weeks old, at which time their bright fresh colors and



Fig. 81. "The King Row." Five Kingfishers in line, illustrating habits of sitting still. July 19, 1900.



Fig. 83. The same birds four days later; thirteen days old, July 23, 1900.

docile natures make them most attractive. They can fly but little, and show no fear. At this stage their habitual expression suggests a peculiar sardonic grin.



Fig. 89. Kingfisher nine days old, showing feather-tubes and tracts.



Fig. 90. At thirteen days ; many of the feather-tubes burst. The blue-black, white-tipped wing-quills project half an inch. Notice that these birds always stand, not on the toes only, but on the short shank or tarsus.



Fig. 91. Kingfisher fifteen days old, with nearly all feathers partly unsheathed. July 25, 1900.



Fig. 92. At eighteen days. The bright blue tints of the upper parts, and the white and chestnut bands around the neck and breast are now very prominent. July 28, 1900.

On the fourth of August I took these birds home in a basket, when twenty-five days old, if their age was correctly estimated. They were about ready to fly and would have voluntarily left their nest in a short time. The nesting chamber had been gradually opened up in front and filled at the rear, until it had



Fig. 93. Kingfishers twenty-two days old. Placed in line to illustrate habit of walking backwards. The second bird at the left has already broken ranks and taken a few backward steps. August 1, 1900.

advanced a foot and a half toward the mouth of the tunnel. At this time fear was possessing them, and a day later it was impossible to handle them without throwing them into a panic. When quiet they would still pose well, would strike with open bill, and walk backwards.

During captivity I fed them on fish which, however, they

would never seize of their own accord. It was necessary to open their bills and press the food well down into their distensible throats. They would perch on a branch placed in their cage, drink water and sit in it by the half-hour, but never touch the most tempting morsels of food. Raw meat was rejected, but they throve on fish if fed by the hand. When perched they stood as before on the whole tarsus or shank, and would sit together in silence, with breasts thrown out, for hours. You heard only an occasional rattle, and that usually in the morning. The Kingfisher's œsophagus is very distensible and the throat is lined with inwardly projecting papillæ, so that when a fish is once taken in the throat it is impossible for it to escape.

The bill of the Kingfisher is grooved on the inside, thus giving the mandibles sharp cutting edges and a firm gripe on the prey. A fish once seized rarely makes its escape, to prevent which the bird has other resources. I once saw a curious trick performed by a Kingfisher, who having made a good capture was perched on a dead tree over the water. In the course of its struggles the fish nearly got free, and for a moment was held only by its tail. The bird with a quick movement of the head tossed the fish in the air, and as it descended caught it by the head and proceeded to swallow it.

When liberated on August 12th, at the age of thirty-three days, the young Kingfishers were suddenly thrown upon their own resources, and it was questionable whether they would be able to recover the instinct to seek and capture prey. However, they were strong and healthy, and I hope that nature came to their aid not only in prompting them to find food, but in starting them south later in the autumn.

CHAPTER XI

NEST-BUILDING

I

NEST-BUILDING had a very early origin and, as every one knows, it is not confined to birds. Even fishes among the lowest vertebrates are not wanting in builders of nests, and the pile of leaves, sticks, and rubbish which the female alligator heaps over her eggs, tier after tier, will at least compare favorably with the mounds of earth raised by the Megapodes or Brush Turkeys. If Audubon is correct, the bird is in this case behind the reptile, for, according to his account,¹ the alligator guards the premises with unusual ferocity, while the Megapode, like the turtle, when the proper time arrives, deposits her eggs, covers them, and goes her way, her "maternal instinct" being perfectly satisfied by the performance of this simple duty.

In that inbred pugnacity which characterizes the breeding season of birds and higher animals generally, we possibly see the origin of the instinct of incubation. The stages of its evolution in the reptilian ancestors of birds may have been as follows: first, burying the eggs, like the turtle or mound-building bird; secondly, burying or concealing the eggs and guarding them, the necessary warmth being furnished by decomposing vegetable débris, as in the alligator, and not directly from the sun; thirdly, laying the eggs and sitting over them to conceal as well as to protect them, in a secluded place, the necessary heat now being furnished by the body of the sitting bird.

In the first instance, the eggs may not have been concealed

¹ "Observations on the Natural History of the Alligator," *New Philosophical Journal*, vol. 2, Edinburgh, 1826-27.

at all, but it seems probable that the instincts of both concealment and pugnacity were contemporaneous as they certainly were very early in origin. According to my idea, the guarding, evoked by the fighting instinct, and supplemented by the instinct to cover or hide the eggs, is responsible for the



Fig. 94. Nest of Cedar Waxwing seen from above, illustrating simple construction; composed of dead grass and weeds. Little more than one third natural size.

origin of the incubating instinct, which is usually strongest in the female, and often confined to that sex.

At all events it has been left for the modern bird to develop an ancient practice on a wider if not on a newer scale, since no other animals have ever possessed their special tools in their present form,—breast, bills, feet, and wings,—and with them the nesting instinct has become not only more general but more highly developed than in any other great order of the animal world.

The building of the nest usually follows courtship more or

less promptly, according to the necessity of the female for dropping her eggs. An imperfect nest does not necessarily imply youth and inexperience in the builder, for when this need is urgent the work is likely to be scamped.

While a few birds lay their eggs on the bare ground, or deposit them in a natural cavity, most gather some kind of nesting material. Many build very elaborate structures, which are often cradle and home combined, securing for the egg an equable distribution of warmth, protecting the young during infancy, and affording the tending parent some degree of comfort, when it does not shield her from sun and rain.

Amid all the endless variety in the position, form, size, and materials of the nest in the different species of birds, or resulting from the vagaries of different individuals, we recognize a certain type-form characterized by the cup or saucer-shaped inner wall, as in the Sparrows, the Crow, the Gull, and in by far the largest number which build nests at all. Such true circular rims, such symmetrical deep or shallow molds, as perfect as if thrown on a potter's wheel, what marvels of art and intelligence do they not suggest! But as we shall see, this stereotyped form is their most mechanical characteristic, and in its essence is as purely ingrained as the form of the egg.

II

We shall strike the root of the matter most surely by following closely the actual process of construction of a single nest from start to finish. Under the head of *nidification*, which many writers seem to have forgotten means *nest-building*, much has been written about the completed product—the nest,—but so little concerning the builders at work that fresh observations should not come amiss on the most common birds.

Certainly among those which perch and sing no better average representative could be chosen than the Robin, and on June 24th, I was fortunate in finding a pair which had made a beginning, and were not averse to being watched.

At the moment my record began, a few minutes before five

o'clock in the afternoon, the rain which was slowly falling promised well for the work of those builders, for whom wet weather is a direct advantage and they are seldom slow to profit by it. At this time a few wisps of dead grass lay on the horizontal crotch of an apple tree which they had chosen, and which I was permitted to survey at a distance of eight or ten feet. The actions at this critical stage are worthy of the closest attention, for they give us the key to much of the later conduct, and as I believe to the essential nature of the actions performed.

It is important to notice that on the first day both cock and hen had an equal share in the building operations, but each worked silently and alone, in perfect freedom and independence. It was impossible for one to observe and therefore to imitate the other, yet their actions were in perfect accord. Indeed so rapid and decisive were all their movements, and so stereotyped and similar were all their acts, it was impossible to decide which bird was engaged unless a paler or more deeply colored breast was presented to view.

The materials were gathered from the ground, from far and near, and consisted of the usual substances,—dead grass, often pulled up by the roots, with the adherent earth, weed-stems, and yarn which I had strewn over the ground. They would sometimes try different objects, rejecting this straw or selecting that weed, and, gathering a full load or as often a ridiculously small quantity, fly straight to their tree, drop their burden, and set briskly to work. As much energy was expended over a few spears of grass as over a larger quantity, and their actions whether necessary or not were the same. They settled upon the first straws and with swaying body, beating wings, and vibrating tail, tended at first to scatter rather than to mold the scant materials. Though as much often fell to the ground as stuck to the limb, such losses were disregarded. Again the bird would turn about, and beat the handful of unyielding weed-stems with the wrists of her wings, or with the bill draw them under the breast, settle down upon them and shake as if in an ague-fit, attempting to use the breast as a

form, when as yet there were no plastic materials to be shaped. With such molding movements one might compare the preen-



Fig. 95. Female Robin brooding: a characteristic attitude when alert, or listening to any unusual sound.

ing actions of nestlings, which begin before there are any feathers to preen.

From one to seven minutes was commonly spent in this round of actions. Only a subdued *cut-cut!* was occasionally

heard, but when another Robin or other strange bird trespassed on their preserve the alarm was promptly sounded, and



Fig. 96. Baltimore Oriole hurriedly feeding her young before all fear has been subdued and behavior is free.

with shrill squeals of defiance the harmless visitor was assailed and driven away. The intruder was taken unawares, and seemed glad to escape from such fiery outbursts of pugnacity.

At each successive visit the characteristic molding and

turning movements were repeated, and thus the work of addition, subtraction, arrangement, and re-arrangement would go on for hours, with serial repetition, and often with needless expenditure of energy. Since, however, more was eventually gained than lost, a stable foundation was gradually reared.

On the first day I watched the progress of building for two hours and thirteen minutes, during which thirty loads of material were delivered by the two birds. In the first half-hour of this period I recognized the female only, who came eight times to the nest-site at intervals of from two to six minutes. Then after a lull of full half an hour the male suddenly appeared, at a few minutes before six o'clock. Twenty-one visits followed at intervals of from one to nine minutes, during the last eighteen of which the cock was positively identified. The last stroke of the day's work was performed by the male at 7.07 P.M., when it was growing dark, and he disappeared. After over four hours of such industrious labor it was truly surprising to find how little had been accomplished; only a slight basis for the proper nest had been laid, for with all of those turning and molding movements so faithfully practiced, no plastic material had yet appeared, and no true nest-form was visible. Could one want better proof of the instinctive character of such actions?

On the second day my record began at 5.20 in the morning, and closed at 4.30 in the afternoon. The actual work of the builders, however, was probably resumed at dawn, for when at more than three hours thereafter—at seven o'clock—the nest was examined, thin walls had arisen, and the proper nest-form was determined.

The building instinct in the male seemed to have been completely satisfied, for while he guarded the premises his mate carried the work to completion. From neighboring trees he watched her labors, sounded the customary signals, and gave chase to casual visitors.

At seven o'clock in the morning of this day, or after eight hours of constructive work, mud began to appear among the building materials. Hitherto the only earth used was that which accidentally clung to the roots of the dead grass and weeds in-

corporated, most of this being shaken out by the treatment which these received. For many hours after, this bird brought mud alone about as frequently as wet or muddy grass. No mortar was deliberately made either at the nest or away from it, but much mixing of mud and grass was effected by the kneading or molding movements, which follow each visit, and as we have seen begin before they are required. That mud and grass alone or mud and grass together are taken at varying intervals can have no special significance. This bird would bring a beakful, dispose of it, and depart so quickly it was impossible to distinguish the sex of the builder or the nature of the substance carried, if the eye wandered but a moment from the nesting place. Sometimes the brown grass would be dripping wet, and the ball of earth carried in the bill larger than a filbert. Once I saw a sprig of green grass taken with a large lump of soil clinging to its roots. Again, a large package of sodden grass would be stuffed crosswise in the full beak, or long streamers of white or colored yarn trailed behind as she flew to the tree, and often caught on twigs or leaves. After troubles of this kind the Robin would now and then fly first to a bean-pole and take up a little slack before proceeding.

On the second day a definite habit of entering the nesting tree and the nest had been acquired, a subject which the reader will find more fully treated in Chapter XIII. With loaded bill the bird steered straight for her tree, dropped to the horizontal branch about a foot from the nest, and came to attention; then if all was well she walked nimbly to the nest, stepped into it, and lost no time in getting to work. After spending two or three minutes or more at the molding and arrangement, she popped out on the branch, brought up to attention, and slid down quickly to the ground, or flying low made off for a distant field. Once when a dog came sniffing through the grass, the cock from his bean-pole perch gave a sharp alarm, but paid no further attention and proceeded to erect and shake out his feathers.

At every addition to the structure, as we have already seen, the materials are churned and worked over afresh, and so violent are some of the beating and shaking movements that

the nest and leaves about it are all set to vibrating in unison. After the circular wall was up and well plastered with mud, this Robin would occasionally pause and sit perfectly quiet for several seconds, apparently resting from the fatigue of her efforts. Sometimes it even seemed as if she were trying the fit of



Fig. 97. Nest of Robin against side of stump, two feet from ground. From photograph by Mr. J. B. Parker. Cleveland, Ohio.

the nest, or was adapting it to her breast-form, but this was uncertain. After such pauses she would turn about and resume work again; then, giving a low *wit-wit!* or *cut-cut!* note, she went off in haste. Once while this bird was busy at molding, a loud *tseet-tseet!* from a neighboring Robin family elicited a quick response in corresponding key, while she went on with her work. When fully alarmed, whether carrying burdens or

not, they fly to a high or advantageous perch, and listen attentively before making another move.

On leaving the nest the female was rarely joined by her mate, who escorted her to the spot where materials were sought, but his efforts stopped at this point. In bringing a ball of mud in the course of the morning, the hen came to the branch in the habitual way, walked straight into the nest, and spent ten minutes, the longest recorded time, in the work of molding. She sat deep down, her head and tail only being visible under the rim, shaking and turning most of the time. Suddenly, with a low *cut-cut!* she was off and in less than a minute returned with another lump.

In the course of the afternoon of the second day, dry grass was added as a lining to the nearly completed nest, when the same turning movements were repeated; but now the custom of sitting quietly for a few seconds at a time, as if laying or incubating an egg, became more frequent, after which would follow more pulling at the materials, and shaking until everything was all a-quiver again. The mud which was brought after this time was apparently incorporated into the nest's rim.

Operations were resumed early in the morning of the third day, and continued about four and a half hours. At half-past 8 o'clock I found this Robin sitting quietly in her nest. After adding a few more touches, and uttering a subdued note as if expressive of her satisfaction in the work, she flew away. When an hour had passed, and she had not returned, I decided to inspect the new abode. It was evidently finished; the walls were firm and true, the rim perfect, and the whole was lined with dry brown grass of a rather fine quality, according to the ancient rules of this guild.

Three eggs were laid June 28-30, between 10.30 and 11.30 A.M. Incubation began June 29, after the appearance of the second egg, and lasted thirteen days; two young were hatched and one egg was addled. At each recorded visit material was brought and incorporated into the nest. The rate of building and the total number of loads of materials which went into this nest are estimated from exact records extending over nine hours.

The building records of these birds may be tabulated as follows:

BUILDING RECORD OF ROBIN.

1903 JUNE 24-26.	TIME.	BIRDS ENGAGED.	HOURS OF WORK.	RATE OF DELIVERY IN MINUTES.	NO. OF VISITS OR LOADS	CHARACTER OF MATERIALS.
1st day	2 P.M. 7.07 P.M.	Male and female.	5	3½	86	Stubble, yarn, and dead grass.
2d day	4 A.M. to 7 P.M.	Female	14	7½	112	Dead grass, wet or dry, and mud.
3d day	4 A.M. to 8.30 P.M.	Female	4½	13½	20	Fine dry grass, and little mud.
Totals.			23½		218	

From the time of completion to the laying of the first egg two days elapsed, and during this interval all was so quiet about the premises I even feared that they had abandoned their nest; but they probably continued to guard it, and certainly did after the first egg was laid.

According to our computation, 218 loads or increments went into this building; it was wrought in about twenty-three working hours, and four fifths of the work was performed by the female. At the nest each bird worked alone and out of sight of the other, so that the possibility of imitation was excluded. It is interesting to see how the rate of building, starting with an average of seventeen visits to the hour on the first day, gradually slowed up to eight visits on the second day and to five on the third, when a new habit was gradually developed, that of sitting quietly in the nest for longer and longer intervals. Later these resting periods become even longer, when the bird stays to lay her eggs and finally to incubate them.

Whenever instinct leads the way, and actions are often



Fig. 98. Female Brown Thrush brooding her young. Lens, Extra Rapid $9\frac{7}{8}$ inch; speed, $\frac{1}{8}$; stop, 32; time, $\frac{1}{8}$ second; plate, Seeds' No. 27 "gilt edge"; distance, four feet; in full sun. July 13, 1900.

repeated, a habit is sure to follow. Instincts are thus constantly being overlaid or replaced by the results of experience. This is seen in the merest trifles as well as in the more important or pronounced activities. Thus, it was not long after incubation began before this bird had adopted a definite position, while sitting on her eggs—her head being always turned in the same direction. Since she faced the path of approach, this habit may have been determined by the habit of approach already referred to, or have been dictated by convenience or the ease by which the avenue of approach could be surveyed.

Many of the details which we have recorded, such as the rate of building, the amount of materials used, the time of dropping the eggs, which according to some observers are laid in the early morning, are relatively unimportant, for they vary with the individual. Far more significant is the general stereotyped character of the actions, which being so nearly the same produce in all Robins so nearly the same results. Few more typical examples of instinctive behavior can be witnessed in higher animals than the serial acts by which the adaptive and often beautiful nest of the wild bird is produced.

The proof of instinct lies in the molding, beating, and turning movements, which are not under the effective control of a guiding intelligence, since they are begun before they are required, are often continued longer than necessary, and without economy of effort. As much energy is often spent over a few straws as over a much larger load, even when the movements tend to scatter rather than to consolidate the materials already gathered.

While instinct holds the reins in nest-building, the actions of the builders are more or less modified or irradiated by gleams of intelligence, although this does not as a rule carry them very far. Here is a small instance in point: when red, white, and blue yarn was thrown on the ground, the white was taken almost immediately, probably because it was the more conspicuous, but it often bothered them to carry a long streamer clear. Once when Cock Robin with his beak full of yarn alighted on the branch and started to walk to the nest, several

loops caught on a stub and brought him up at a short turn. The situation afforded a good opportunity for the display of intelligence (a good chance, too, for an animal romancer to spin a yarn), and the bird was not wholly wanting. He first tried to force matters by putting his whole weight into a lateral strain, but failing in this he faced about, back to the nest, and pulled with the same result. Then he advanced a step or two, gathered up a little slack, and pulled again, this time losing his hold except on a few strands which were drawn up and incorporated into the nest. After seven minutes spent in molding he walked out on the branch and picked up another thread of yarn, but the rest was left clinging to the stub, and no further attempt was made to remove it. While a start was made in the right direction, the simple solution of the problem, to release the yarn with the bill, did not occur to this Robin. From long observation, I am convinced that birds seldom comprehend the conditions of what seem to us the simplest situations, but exceptions no doubt occur. I have seen a young Chipping Sparrow swallow a horsehair, and the mother remove it, while I have known of an Oriole becoming entangled in its nest and allowed to die without any attempt at rescue being made by its mate.

III

While watching the Robins, my attention was often diverted by a pair of Chebecs, which early began to appropriate the yarn and carry it to a certain tree where I knew that a nest was well under way. They were so greedy with this material that I determined to satisfy them, and getting a quantity of cotton cloth I tore it in ribbons from one to two feet long, and with a quantity of white hens' feathers strewed it on the ground. We soon witnessed some curious sights, and the nest which was later completed was in some respects the most remarkable I have ever seen.

Ordinarily this little flycatcher uses the finest grade of vegetable fibers which have been swingled by wind and rain, and bleached to that neutral gray tint which to the ordinary eye passes for lichens or gray bark when implanted in the

crotch of a tree. It has, I believe, never been shown how this bird makes the wall of its nest so compact and smooth. This pair worked two days at building, during which the characteristic molding movements, which we have seen in the Robins, were repeated in the same mechanical manner, but when the walls were up a peculiar smoothing process was applied to the outside. Standing within the nest and leaning over its brim, this bird would "iron" the outside with her head. Bending down, she drew alternately the left and right side of the head and neck over the outside, in one continuous movement, as you would strop a razor. The little bird practices this "ironing" process frequently, turning about until every part of the outer surface has been reached. While thus engaged you would hear only an occasional *chick-chick!* When the walls were up, the smoothing movements were repeated at each visit, whether any material was added or not, after which the bird would sometimes settle down, turn, and shake like a Robin. Once while engaged with the lining, and a feather accidentally stuck in the mouth of the worker and refused to move, the bird flew to a branch and energetically rubbed its bill until relieved. In gathering the nest material, a regular course of action was generally adopted. Coming first to a bean-pole, at least one of them—probably the male—would call in his incisive way *chebec! chebec!* look about cautiously, drop to the ground, select something, and fly by easy stages from tree to tree to the nest-site two rods away. The streamers being difficult to manage often caught on branches or dropped to the grass, so that a regular trail was eventually established, leading up to the very nest itself.

This nest was placed high in an apple tree, and when finished was almost wholly composed of white yarn, cotton cloth, and the hens' feathers, which I had supplied to the birds. They were compacted as well as their nature would admit, but all about the nest and hanging from every part of it were streamers of white cloth from one to two feet long, making it in all probability the most conspicuous if not the most curious piece of nest-building ever executed by these birds. Since there was three times as much material as was needed, and most of this

not of the proper sort, one is at a loss to explain such a departure from their usual custom. However, whatever may have been the previous experience of these birds, this nest, though completed, was never occupied, and in three days it was torn down and the materials disappeared.

IV

The nests of Chipping Sparrows are notoriously defective in point of stability, and frequently suffer from this cause, as well as from a lack in the proper materials of construction. Although the hair lining is well modeled, a proper foundation is seldom laid, and the whole fabric is often so thin that the eggs can be seen through its walls. The winds frequently knock the bottoms out of such nests, but the Sparrows are incapable of profiting from such experiences, and persist in following a stupid instinct which in this case is veritably a blind and inefficient guide.

While watching the Robins and Chebecs, I could also follow the behavior of a pair of these Sparrows who were engaged in the same operations. The same molding movements which we have described were repeated in the Sparrows. After this nest was essentially finished the behavior of both birds was most suggestive of the instinctive character of all their actions, and of their chain-like relation. The female would drop to the ground, twittering all the while, and with wings spread and quivering await the approach of her mate; the action was usually quickly repeated, when the female at once repaired to the nest, sat in it for a few minutes, and then flew off. In the course of a little over two hours, these actions were repeated four times. At eight o'clock in the morning of the following day there was a repetition of this performance, the female always going to the nest and remaining about three minutes; at times there would be a *recurrence of the molding movements, but nothing was added to the structure*. These actions were continued until the first egg appeared, and illustrate in the clearest manner how one set of serial instinctive acts shades into another series, which are also instinctive, but of a different character.

V

In the home and nursery of the Gull we see how communal life has affected their behavior at every turn, and especially the nest and all that concerns it.

When pairing has been accomplished in the Great Herring Gull, the nests are built either on the ground or in trees, both



Fig. 99. Eggs of the Great Herring Gull, in ground-nest, composed of grass, sheep's wool, and feathers. Great Duck Island, Maine. July 23, 1902.

birds having a share in the work.¹ They take any materials which come to hand, pulling grass and weeds, splitting up the dead timber into chips with their powerful chisel-shaped bills, gathering sticks, feathers, or sheep's wool from the ground, or fresh seaweeds from the rocks. A last year's nest is sometimes repaired, but whether by the original owners or not is not certainly known, or a new site is chosen. To this point the

¹ This is at least true later in the season when sporadic attempts at nest-building are going on.

materials are brought and dropped when the bird immediately settles upon them, very much like the Robin, and scratching with its great webbed feet, and pressing with its beautiful white breast, it practices all the typical molding movements upon the inchoate mass. But whatever the material, whether green and brown seaweeds freshly plucked from the rocks, or



Fig. 100. Gull sitting on the nest shown in Fig. 99.

chips inlaid with fresh grass and weeds, they build a symmetrical and often beautiful nest, with a shallow bowl, about ten inches in diameter.

A curious fact, however, with these Gulls is that the nest-building instinct is so diffused that they are pulling grass and picking up chips all summer long, sometimes dropping this material, sometimes carrying it to their nests. They will frequently repair old nests and incubate addled eggs, and I have seen the dead body of an unfortunate chick treated as so much building

material in such a nest, from which no young had been successfully reared. Very often, too, late in July, when some chicks have taken to the water, nest-repairing is not only kept up, but many brand-new nests are begun which can never be occupied. In some of these, which are rarely finished, eggs are even laid, but it is too late for the successful rearing of chicks. When we see a Robin with stubble in its bill, the meaning is clear and infallible. The nesting season for Robins is on, and that bird has eggs to be laid and probably to be hatched. Only the other day, October 30, I saw a House Sparrow fly up towards the window with a sprig of dead grass. No doubt it was building its bag-shaped winter house or lodge; but when you see a Great Herring Gull toying with sticks, grass, or feathers, it is impossible to say what it means. You must watch and see, and the sights which are likely to follow are often well worth watching.

I have seen a Gull standing on the rocks pick up and drop several times a stick one and a half feet long, as if listlessly playing with it, or seeking an outlet for its energies. I have seen a timid Gull, when approaching its nest of eggs, hesitate, and then picking up a chip, advance a few steps nearer, as if gaining assurance by such actions. I have seen an old Gull, while sitting on eggs, repeatedly reach out and pull up grass by the roots and incorporate it into the nest. In sparring bouts, which are sometimes the prelude to desperate encounters, these birds will stand facing each other like fighting cocks, cats, or dogs, when suddenly one will give the other a vicious lunge. Very often such sallies come to nothing, when one or both birds seem suddenly to lose all interest in the quarrel, and begin to pick up chips, pull grass, or stab a rotten log with their strong, chisel-pointed bills. At other times the encounter is more friendly, and probably corresponds to what in other species, like the Albatross, has been described as a dance. Bending until the breast touches the ground, and bringing the head up and down with quick jerks, they give a peculiar crooning note. Then they begin to play with chips and grass, and after indulging in frequent screams finally separate, or begin their elaborate toilets.

It is curious to see a pair of birds attended by chicks whining

for food, repeatedly offer them grass and sticks before producing the fish which they carry in their stomachs or after having fed them, gather a mass of grass, carry it away, and deposit it at the foot of a stump, as they do when actually building a nest.

It is thus plain that in such actions we have the expression of a great variety of emotions. In some cases they lead to the repair and temporary occupation of old nests at the close of the season, when for days at a time the old birds, as if with instincts imperfectly satisfied, will incubate an addled egg. It is not improbable that in such sporadic actions, as in the more serious work of actual nest-building, similar emotions are expressed in a similar way.

At all events this behavior of the Gull sheds light on the reputed intelligence and forethought of the Ospreys, which are said to repair their nests at the close of summer in anticipation of the coming year. This casual return of the nest-building instinct is undoubtedly the same in the Hawk, Eagle, or Gull, and implies no more forethought in one than in the other. I think we can understand why some birds, like Robins and Phœbes, occasionally build more than one nest, and, unlike the Gulls, build them together and in the same spot. *Their instinct is not satisfied with the building of a single nest.*

VI

The philosophy of nest-building is set forth in a new light by the study of the Gulls and Terns. Mr. Wallace once maintained that the young of wild birds learned enough about their nests in infancy to enable them to reproduce the same type of architecture when they came to rear offspring of their own. It was also affirmed that the beginner in this art received aid by mating with an older bird. The first notion is not to be taken seriously, and in support of the second the testimony is insufficient. It is now almost universally admitted that the initial steps in nest-building are in every case instinctive, or independent of experience.

It is impossible to suppose that young birds have conceptions of any kind, or are able to distinguish their artificial nest

from such natural objects as leaves and trees. We might go even a step further and maintain that some adult birds, like certain of the Terns, have no knowledge of the use to which the nest is put.

A nest like that of the Oriole or the Robin, the building of which we have watched, is composed of hundreds of pieces or increments—fibers of grass, roots, strings, pellets of earth or



Fig. 101. Common Tern brooding a chick away from the nest. Matinicus Rock, Maine. July, 1902.

what not—molded into a compact and symmetrical whole, which serves a definite purpose, and serves it so admirably that it is difficult to avoid the conclusion that the bird knows what that purpose is.

If, while some Robins built a perfect nest, and others built none at all,

still others should make a beginning but stop short at every stage of incompleteness, it would be occasion for surprise, to say the least. Yet, this is precisely what the Terns do on Matinicus Rock, Maine. Some lay their eggs in a rocky crevice or depression, where they often drown in the water which collects after rains, or are rolled out by the wind and perish; others gather half a dozen bits of mussel shell not larger than a dime from pools a few yards away, or bite off a few bits of green leaf or weeds, and this answers for a nest; still others carry the building to completion, and fashion a really commodious nest. Every stage in the process is represented after operations have ceased and the eggs have been laid. Surely were mankind to conduct their building affairs in this indecisive, haphazard manner, they could not be credited with any intelligent sense of the use which houses or even temporary shelters are intended to serve.

CHAPTER XII

DEVELOPMENT AND CARE OF THE YOUNG

I

EGG AND CHICK

THE nest or the spot on which the eggs are laid becomes in most birds the center of the home-life, and is the focal point of our interests, because it is there that the young are born. We have briefly analyzed the principal terms of the reproductive cycle (Chapter I.), and have seen the rise and interplay of a series of commanding instincts, which develop in a definite order and run a definite course, one, if unchecked, leading to the next in sequence. When the young are hatched, a complicated routine of nest-life is developed. The parental instincts reach a climax and then, gradually yielding to impulses of another kind, subside.

Each term of the cycle invites us to renewed study and observation in all the great families of birds, but we can mention only a few of the interesting facts which have been gathered, or were already known.

The size, form, and color of the eggs, as well as the time when they are laid, are subject to great variation, not only in birds as a class, but in a lesser degree in the same species, and even in the same individual.

The ovarian tube is no respecter of particular eggs or egg-fragments, but treats all alike. Double- or triple-yolk eggs are occasionally seen, but still rarer cases are recorded in which a normal egg of the domestic fowl or goose, with one or even two yolks, was enclosed in a shell of colossal size. Again, a small egg or

only parts of one may get a shell in due course, thus producing the "runs" occasionally seen in nests. Indeed, I have known in the common hen a single instance in which a small and imperfect egg with a shell was incased in the yolk of a large and normal egg, so that the curious anomaly of egg within egg was produced in a most striking manner. In such rare cases the small egg, though possessing a shell, is imperfect.

Spots of pigment, when present, are often blurred, or, as in the Orioles and Blackbirds, drawn as with a fine pen around the shell, clearly showing, if other proof were lacking, that the egg not only rotates on its long axis, but often oscillates in the downward course in the ovarian tube.

The delicately colored eggs of many wild birds are among the most beautiful objects in nature, but what this wonderful display of color really means is doubtful. The pale greenish-blue, brown-mottled eggs in the open nest of the Song Sparrow seem to be protectively colored, because they match their surroundings so perfectly, yet the Crow also lays mottled eggs, and the European Magpie, which produces eggs of the same pattern, effectively conceals them by building an arched roof over its nest, which is entered at the side.

A long time ago it was observed that the eggs of many birds which are laid in dark holes are often white, as in Parrots, Woodpeckers, Kingfishers, and Swifts. It was only natural to suppose that the lack of pigment might be due to the absence of light, and further that it was a useful adaptation, since the whiter and more conspicuous the egg the more likely was it to escape injury from the owners when entering their dimly lighted apartments. Here also many exceptions occur, which may be due to the fact that the color of the egg is a more stable character than the nesting habit.

As in all other animals, the relative size of the egg is directly proportional to the degree of development attained by the young at birth, the altricial Robin or Cedar-bird laying a relatively smaller egg than the præcocial Snipe or Grouse, which is able to run about from birth or as soon as dried off.

The eggs are usually laid on successive days, and in definite

numbers, subject to variations, some of which have been already noticed (Chapter I.).

The Chipping Sparrow mentioned in the last chapter laid three eggs on successive days, very punctually at about half-



Fig. 102. Great Herring Gull turning eggs with bill, on entering her nest.

past four o'clock in the morning. The molding movements and habit of sitting for a few minutes in the nest were continued until close upon the time when the first egg was laid on the 27th of June. At 4.40 A.M., June 28th, the female was on the nest and came off at 4.49 A.M., leaving two warm eggs. Incubation began early in the afternoon of the second day. So strong had the instinct already become that the bird even clung to her eggs when I climbed into her tree and shook the limb which held the nest. On the third day, June 29th, the Sparrow left her nest, now containing three eggs, at 4.56 A.M. At three o'clock in the afternoon the sitter was absent, but three quarters of an hour later, when it was raining, the Sparrow returned.

On the fourth day the incubating instinct was then fully developed, and lasted until two of the eggs were hatched, on about the tenth day of July. The period of incubation was approximately twelve days, and when three days old the eyes of the little birds had begun to open, and the feather-tubes of their wings had appeared. In still another nest of this Sparrow, in which two eggs only were laid, incubation did not begin until the third day.

For ages the greatest secrets of the living world have been securely locked in the egg, and it is only in recent times that science, with any degree of success, has succeeded in partially opening them to view. Development begins in the warm body of the parent bird, and in most cases comes to a stand the moment the egg is laid. The physiological zero-point of temperature at which no further development takes place has been accurately determined in the domestic fowl.¹ When heat is again applied by the brooding hen or the artificial incubator (the normal temperature for development of the fowl's egg being about 103° F.) the engines of cell-life are again started, and the wonderful process of orderly growth, with the ensuing changes, is taken up anew. If the fires are again banked and the engines stopped by withdrawal of the heat for any length of time, it is impossible to start them again, so we kill the egg, and perhaps the goose which might have laid another, at the same time. The strong brooding instinct in birds, which often supplants the usually strong instinct of fear, is thus adapted to meet a very urgent need.

The yolk, and later the white or albumen, furnishes a natural store of food and energy, which, like money in the bank, can be drawn upon by the growing cells or embryo, until, enclosed in the stomach of the little bird, it is gradually exhausted, when the latter is ready to receive food from another source.

Owing to some perversity of instinct, the domestic fowl will occasionally eat its own eggs; wild birds often desert theirs through fear, or, as more commonly happens with sea fowl, lay them in places of insecurity, but as a rule these fragile objects

¹ According to Professor C. L. Edwards, this lies between 68° and 70° F.

are treated with the greatest care. When broken open they are either eaten or carefully removed by all birds which possess the cleaning instinct, an illustration of which we have already seen in the Common Tern. (See p. 33.)

The Herring Gull upon entering her nest usually turns her eggs with her bill, and if you change their position she will invariably turn them again. The domestic hen stirs up her eggs with her feet. There is something more than the comfort of the sitting bird involved in such acts, for the eggs need damping, and by this means each side of the egg is exposed to the moisture of the ground or bottom of the nest. Then, in a full nest, constant rolling tends to equalize the distribution of warmth, bringing all the eggs successively into the warmest place. The turning is even more useful in preventing the germ or embryo from sticking to the shell, a necessity recognized by the breeder of domestic fowls, who twice daily turns the eggs in his incubators.

The embryo appears first as a thin disc on the surface of the yolk, over which it gradually spreads until the whole is enclosed as within a sac. It always lies uppermost, next to the warm breast of the mother, for in the first place the egg is lightest at its growing pole, and in the second the spherical mass moves



Fig. 103. Photomicrograph of the chick in the egg, at the thirty-third hour of incubation. The vesicles of the eyes and brain, the delicate, tubular heart, and the primitive segments of the body are plainly seen. Embryo, one-fifth inch long; enlarged nearly ten times.

freely in its liquid envelope, so that whenever the entire egg is rolled, the yolk, becoming top-heavy, quickly adjusts itself, always keeping right side up.

The embryo, which at first rests upon the huge mass of yolk, lies across the long axis of the egg, but later it gradually shifts to a lengthwise position, until, bent and twisted, it becomes compactly folded within the narrow confines of the shell.

In the common fowl the heart begins to beat at the beginning of the second day, and earlier in most wild birds.



Fig. 104. Egg of the Great Herring Gull with part of the shell chipped away to show the chick inside. The bill is thrust into the air-chamber at the larger end, and bears a large spur or "egg-drill." The head is twisted about so as to lie under the right wing, and the remains of the yolk-sac can be seen beneath the folded webbed feet.

A protective water-jacket is early formed around it, and a temporary "lung" is developed. The latter is in the form of a thin-walled sac, which closely underlies the shell. Meanwhile an air-chamber has slowly made its appearance at the larger end of the egg, between the hard shell and underlying membrane, in consequence of evaporation of the white; into this the bill of the little bird is unerringly thrust, and with its stout spur or "egg-tooth" is soon pressing against the shell.

Invigorated by the air which is now drawn into the true lungs, the chick presses hard against the walls of its prison, and its first muffled bleats are faintly heard. The egg is starved, pipped, and finally cracked open, usually into two unequal halves, by a fissure extending around the larger end. Wet and trembling, the little chick slowly crawls forth into the world of light and action, and its new life begins.

The whole process of development in the egg is wonderfully rapid, lasting from two weeks or less in the common land birds to seven weeks in the Ostrich.

The cast-off shells are carefully removed by many birds and

dropped at a distance from the nest, while in others they are disregarded altogether. At an early period of development the slightest crack is likely to addle the egg, but unless it is actually broken open it is usually allowed to remain in the nest. Many wild birds will "incubate" stones, or addled eggs, showing in this respect hardly more discrimination than the domesticated hen, and the Great Herring Gull, after wasting much time over a barren egg, will often use it as so much building material in preparing a new nest.

In one instance I have seen this Gull pick out the soft respiratory sac from the shells, and devour it on the spot, a curious and sporadic act, which is probably not confined to this species. It suggests the well-known and useful instinct in many of the higher mammals of eating all such parts as might betray their presence to an enemy.

II

BROODING AND FEEDING THE YOUNG

When the callow young are hatched, brooding is the order of the day as well as of the night, and in some species the young seem to require this kind of protection as much as food. During the first days of life in the nest it is not easy to distinguish a brooding from a sitting bird, but this is not the case when a little later the mother begins to rest her wings over the rim, or, spreading wings and tail stands astride the nest with back to the sun. The young must be protected from heat, cold, and rain, and the instinct to perform this duty is as strong with old birds as that of bringing food.

Cedar Waxwings and Kingbirds which I have watched, brooded regularly at night, but I have known young Robins to be left alone in the nest. Should the day be cloudy but with no rain, or sunny but not too warm, little or no brooding has been observed among the various species which I have studied, but let the sun beat relentlessly upon the young, or the air become laden with moisture, and the faithful mother is promptly at her post. I have seen the Robin brood the young when eleven

days old for forty minutes at a time, while her mate brought an abundance of food. As he approached with an insect or cluster of worms, she would step aside, but immediately settle back on the nest when the food had been safely disposed of. As a rule, however, she would brood for five or ten minutes, leave at the



Fig. 105. The Chestnut-sided Warbler in her common brooding attitude.

approach of the male, return promptly with food, and brood until her mate again appeared. On several occasions I have seen a brooding bird leave the nest when the sun became temporarily obscured, and return when the clouds lifted. It was not quite certain, however, that the element of chance did not vitiate the observation.

While camped beside a nest of Brown Thrushes (see Figs. 44 and 98), the young of which were approximately four days old, the female came to the nest for inspection frequently on the first day of observation, and brooded intermittently, but fed her young only once in the space of three and a half hours. When I frightened this bird off with the hand thrust through the tent-window, she would dart at it, scold emphatically, but in a few moments return to her brooding again, as if her young

required this attention more than food. In some cases the chicks of the Great Herring Gull are not fed until two or three hours after birth. The strong brooding instinct of the Flicker will be noticed later.

The Chestnut-sided Warbler, who is represented in many characteristic attitudes about the nest, was a most devoted brooder for days. She would stick to her charge until driven off by sheer force or by hunger. I have often seen her drop down in the grass, pick up a morsel on her own account, and be back to the nest in a fraction of a second before the insect was fairly swallowed. Again she might leave



Fig. 106. Female Chestnut-sided Warbler bristling while brooding on a hot June day.

the nest twenty times in the course of an hour to procure food either for herself or her children. Her mate would often alight above the nest, bend far down, and deliver the insects into the mouth of the brooding hen, who would promptly hop up and give every morsel to the young.

This little warbler would sometimes sit well down in the nest, and erect some of her feathers, and apparently inflate the throat so that the bird's head appeared as if swollen to twice its

natural size. She made the most comical picture, however, when on a hot day she stood or sat over the young, with every feather erect, as if striving to keep them cool and to be comfortable herself meanwhile.

The female Kingbird broods constantly when the heat is



Fig. 107. The same brooding bird, with feathers partially erect and the throat inflated.

severe, and at the approach of the male will often assist in dispatching unruly insects and in seeing them safely down a responsive throat. The persistence of the Redwing Starling in this line of conduct is admirable. I have seen one of these birds stand with drooping wings, erect feathers, and mouth agape, in the strong heat of a July day for hours though

not continuously, for she invariably left at the approach of her mate for a few moments' respite, and then usually returned with food.

This spreading over the young, often with erect feathers, has been witnessed in Blackbirds, Flycatchers, Warblers, and Cedar-birds (see Figs. 10, 34, 108), but, so far as I am aware, it had never been described until the former publication of this work. So common a practice must, however, have been often observed, yet I was somewhat surprised to find that it had been noticed

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by the early Egyptians more than 4000 years ago, and was depicted by their artists on the walls of many tombs at Sakkara and elsewhere in Egypt. Moreover, their birds are usually



Fig. 108. Female Kingbird astride nest with drooping half-spread wings, shielding her brood from the hot sun. Notice the characteristic attitude of the young.

represented as resting on the whole shank or proper foot, as is often the case (Fig. 109).

After taking a bath, it is the custom of many species, like Pelicans, waders, and birds of prey, to spread in a similar manner to dry off, as may be seen in any zoölogical garden, but many are inordinately fond of the sun-bath alone, and the hotter the day the better they seem to enjoy it. I have seen the remarkable Shoebill Crane or Whale-headed Stork in the gardens

at Cairo, sitting on the grass in the blaze of an African sun, with full-spread wings, in the attitude depicted on the Egyptian tombs, when shade in plenty was close at hand.

Again, at Lucerne, Switzerland, on a hot day in July, I saw a female Thrush (*Merula atra*), the first cousin of the American Robin, lie stretched out in the sun, on a bare patch of earth in a garden, not far from its nest, with wings spread and



Fig. 109. The earliest pictures of the home-life of birds. Detail from hunting scene in marshes on the Nile, from the tomb of Mereruka, at Sakkara, Egypt, over 4000 years old. Birds are nesting in the papyrus reeds, and a pair are defending their young from the threatened attack of a mongoose. Notice that the birds sit on their saucer-shaped nests, and "spread" as they do when taking a sun-bath.

feathers on end, for two or three minutes at a time, and then go to a branch and preen. This was repeated four times in succession, the sun-bath lasting from two to three minutes each time, and the bird always going to precisely the same spot. The same act was, moreover, observed on successive days. It is therefore suggested that the spreading is a typical reflex (see Chapter XIII.), or motor response to heat, and that it is not necessarily a signal of distress. The return to the same place day after day to sun or dust the feathers, or to favorite perches to preen or

devour the prey, are only additional illustrations of the force of habit. (See Chapter XIII., 11.)

While possessed by the incubation or brooding spirit many birds, as is well known, are indifferent to danger and will hug their eggs at any cost. In this respect few can excel the "tame villagic fowl," who displays greater docility than most wild birds, for they rarely sit on an empty nest, and have been known to reject strange eggs. The hen will peck vigorously at the in-



Fig. 110. Great Herring Gull yawning, while engaged in the prosaic task of incubation.

truder, and if hustled off the nest will soon return. Some birds, like Song Sparrows and Brown Thrushes, will remain immovable as if hiding until you come dangerously near, when they glide off silently, but usually remain quiet for a moment only. The Robin flies off in a passion. The Tropic Bird fights but sticks to her egg. The Woodpeckers are close sitters and may be taken in the hand, as we shall see later. A Chickadee which I worried with a straw would peck angrily at it, but remained on the nest. The Cedar-birds retire in silence. In this state birds become passive merely through the temporary suppression of the sense of fear.

The Cedar-bird gapes persistently when uncomfortably warm, but only the crest feathers are ever erected, and then not to the extent usually shown in drawings of this species. Both Robins and Catbirds bristle up when their nests and well-fledged young are assailed, and general erection of the feathers may be occasionally seen in the brooding bird, but their emotion is usually expressed by raising the feathers of the crown.

While the practice of gaping is as common with many birds as with the dog, comparatively few, of which I can now mention



Fig. 111. The eggs of the Cedar Waxwing, and its young in various instinctive attitudes when about a day old. "Rising upon its pliant stomach as upon a pillar, with neck up-stretched and trembling like a tuning-fork, it opens wide its mouth. Press the button, and up goes its head again and again, until fatigue comes to its aid." Nearly one half life-size.

with certainty only the Pelican and the Gull (Fig. 110), are capable of indulging in a genuine yawn. In this act the Gull derives the same sort of relief as dog or man, and is no more graceful in its performance. At the close of expiration in the gull the throat expands, and the tongue, which is up-raised, draws with it the larynx, and thus gives free passage to the air.

The duty of brooding rests mainly with the female in our common land birds, but the male in some species either regularly or intermittently takes his turn at the nest.

Passerine birds feed their young at brief intervals from early morning until nightfall, but apparently seldom if ever after dark. The Night Hawk, as has been seen, broods by day, and

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feeds its young at dusk, or just after dark, and probably again at dawn. Both sexes usually share in bringing food to the nest, but this rule is by no means universal.

The young require animal food during the early days of life, and in the interior of the country this consists mainly of insects in the larval or mature stages, spiders, earthworms (at least in the Robin), and possibly slugs. Even snakes and frogs, to which Hawks and other birds of prey devote much attention, no doubt at times fall a prey to smaller adversaries. In the hills above Lucerne, Switzerland, on the tenth of July I once surprised a Thrush (*Merula atra*) hammering at a small snake. The animal, when whole, measured only seven inches in length, and this bird had already cut off two inches of its tail, which was possibly intended for its young. Aside from the habits of the adult, the nature of the food brought depends much upon the character of the supply. If food is plenty a wide choice is possible, but at the pinch of hard times every rule is broken and nothing is refused. When the Kingfisher finds crayfish abundant they are carried to the nest, and this species has also been known to go to the fields for insects. Along the coast various other invertebrates undoubtedly contribute to the food supply of both young and adult birds of many species. Birds which never taste of fruit themselves naturally do not give it to their young, while Robins, Orioles, Vireos, and Waxwings, to mention but a few of the berry-pickers, vary the diet of their fledglings with a liberal supply of fruits of various kinds.

The food is placed not simply in the mouth of the young but well down into the sensitive throat, and if the bird does not immediately respond, it is withdrawn and passed to another, and often to a third, until a throat is found which has the proper reaction time. If the gullet is already full, the swallowing reflex is inhibited, and the bird must wait. If the experiment of feeding a young bird like a Robin at the nest is tried, it will be found that the food passes slowly down the œsophagus, and when this is filled no more can be taken until the channel is clear. The gullet thus acts as a brake to the tendency of the greedy young bird to gorge itself to suffocation. Cedar-birds, however,

according to Audubon, will sometimes eat to such excess as to be unable to fly, and a number of wounded birds of this species which he kept in a cage ate of apples until suffocated. When opened they were found to be filled to the mouth.

The automatic response given by the young is the signal awaited by the old bird, though often with impatience. The



Fig. 112. Female Redwing Blackbird placing food in the throat of a nestling.

insect, after being placed in a nestling's throat, is watched until it disappears. Should it stick at the gullet it is withdrawn and replaced time and again, or given a gentle pull, until it is safely down. Sometimes the insect is deprived of its legs or wings, bruised against a twig, beaten into a pulp, or crushed and torn asunder between the bills of the parent birds before it can be safely delivered. As has already been seen, many birds utter a peculiar note as a special stimulus to the young. At such times

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even the silent Cedar-bird finds a voice and gives an impatient *cheet!* If this premonitory call passes unheeded it becomes extremely shrill, especially in Kingbirds, with whom failure on the part of their young to quick response seems to be peculiarly exasperating.

While watching a Kingbird's nest from the tent, a moth



Fig. 113. The same bird watching the food in the throat. If not immediately swallowed, the insect is withdrawn and passed around until a bird with the proper reaction time is found.

millar was once brought in by the male. It was passed to each one of the young in turn, but even under the spur of his shrill chitter they were unresponsive, and he devoured the prey himself. This sharp economy is often practiced at the nest, and I have even seen the leg of a grasshopper picked up and eaten by an old bird. Not a crumb is allowed to go to waste. If an insect gets away it is usually pursued and immediately snapped up. Once, however, I saw a female Kingbird fooled by

a fly who owed its life to its small size. As she opened her bill in her attempt to land it safely in an open throat, the fly darted off. The bird seemed dazed for a moment, and stood gazing at the departing fly as if in mute astonishment.

Exciting scenes usually follow at the nest of the Kingbird



Fig. 114. Kingbirds bruising a too active grasshopper between their bills preparatory to serving it to the young : the female in front with tail full-spread.

when a large dragon-fly, cicada, or grampus is brought to the family circle. The insect often struggles hard, but escape is out of the question, especially with both birds at the nest, who at once begin to rend and crush it with their bills.

The male grampus (*Corydalis cornutus*), better known as the larval hellgamite of which black bass are sometimes extremely fond, has long gray wings folded back over the body when at

rest, and the head is armed with horns an inch long but formidable only in their appearance. I have seen these huge insects



Fig. 115. Brown Thrush feeding a nestling. "The food is placed not simply in the mouth of the young, but well down into the sensitive throat."

measuring four inches from tip of the jaws to the extremities of the folded wings fed to a single bird, and they were swallowed—wings and all. The operation is shown at an incomplete stage in figure 116, where the wings of the grampus can be

seen projecting an inch or more from the mouth of the struggling bird.

The cicada is even tougher and harder to manage, but is



Fig. 116. Female Kingbird assisting a grampus down the throat of a nestling. The long gray wings of this insect are protruding from the mouth.

beaten into subjection, and served up in a limp condition. One day in August I watched a street combat between one of these cicadae and a House Sparrow. The insect was bounding up and down on the ground and sounding its *crescendo* at an alarming rate, but unable to avoid the blows which rained from the Sparrow's bill. As the music of the dying cicada finally ceased, the Sparrow picked up his victim and bore it off to his brood.

III

GROWTH OF THE NESTLING

The phenomenal growth of the young bird at the nest will be appreciated when we reflect that in two weeks it increases in

weight twelve-fold; it develops keen senses and complex instincts, acquires a serviceable and comely dress, and is ready for flight.

This was well illustrated by a nest of four Cedar-birds, one of which hatched in my hand on the twelfth day of August; three which lived to grow up were weighed and measured daily for a period of fifteen days, from birth to the time of flight. The eggs from which these birds were born were nearly of the same size and weight (at time of hatching weighing $38\frac{1}{2}$ grains or nearly $\frac{1}{8}$ ounce), but by the end of the first day marked differences in rate of growth had appeared, and were constantly maintained.

The weight of the most vigorous nestling was doubled on the first day, more than trebled on the second, and nearly quadrupled on the third. On the twelfth day, when it weighed approximately one and one fifth ounces, and had increased in weight thirteen-fold, it left



Fig. 117. Male grampus, *Corydalus cornutus*: full size, from life.

the nest. When captured at the age of fifteen days, it had grown one half inch in length, but had lost one twelfth of an ounce in weight.

The next in point of vigor increased twelve times in weight, or on the fifteenth day attained the stage reached by the first bird when from eight to nine days old. Nestling number three increased eleven times in weight in the same period. The horizontal slits of the eyes opened on the fifth day in the first bird; at a week old the feather-tubes had burst all over the body excepting the quills of the wings and tail which began to emerge from their horny sheaths on the eighth day, and on the twelfth day the first unmistakable signs of fear were exhibited.

At a corresponding rate of growth a ten-pound baby, when one day old, would weigh twenty-one pounds, and at the age of twelve days one hundred and thirty-four pounds.

From the first to the fifteenth day the strongest of the three birds had increased in length nearly three times (measurements, $1\frac{1}{2}$ and $5\frac{1}{4}$ inches).

IV

CLEANING THE NEST

The sanitary condition of the young is a matter of great concern to most birds, who as a class are extremely neat and clean. This is especially true of the many species breeding in holes or cavities of any kind like the Woodpeckers and Chickadees, the young of which are crowded in close quarters or even piled up in more than one layer. The Woodpecker's hole and the Bluebird's nest are always sweet and clean, and the nestlings immaculate.

The duty of inspection and, if necessary, nest-cleaning follows each feeding with clock-like regularity, and is one of the most characteristic and important activities to be observed in the nesting habits of a large number of the smaller land birds, yet apparently it is not mentioned in the standard treatises of ornithology, and I have found but few references to it in works

of any kind.¹ Audubon, who has probably recorded more facts on the behavior of American birds than any other writer, does not, I believe, mention this important function. The reason is not far to seek, for without the possibility of close approach to the nest, and the use of a convenient blind, such acts are difficult or impossible to observe.

The instinct of inspecting and cleaning the nest is mainly confined to the great passerine and picarian orders represented in this country by hundreds of species. It is a well-marked trait in Thrushes, Waxwings, Vireos, Warblers, Orioles, Blackbirds, Woodpeckers, Wrens, and Titmice, to mention those families in which it has been regularly observed. Gulls and Terns, however, possess the cleaning instinct in a minor degree, as I have observed on one or two occasions.

The excreta of the young of most land birds leave the cloaca in the form of white, opaque or transparent, mucous sacs. The sac is probably secreted at the lower end of the alimentary canal, and is sufficiently consistent to admit of being picked up without soiling bill or fingers. The parent birds often leave the nest hurriedly bearing one of these small white packages in bill, an action full of significance to every member of the family. I have seen the Oriole carry these packages a few rods from the nest and drop them before alighting. The Bluebird and Redwing Blackbird take them a long distance before letting them fall. Crow Blackbirds sometimes drop them in the water, and House Wrens and Nuthatches implant them on the bark of trees.

Removing the excreta piecemeal and dropping it at a safe distance is the common instinctive method not only of ensuring the sanitary condition of the nest itself, but, what is even more important, of keeping the grass and leaves below free from any sign which might betray them to an enemy.

Many other birds, of which I can now certify the Robin, Catbird, Cedar Waxwing, Red-eyed and Warbling Vireos, Kingbird, Redwing Blackbird, Brown Thrush, Chickadee, and

¹ See the original and excellent *Researches in Zoölogy*, by John Blackwall, 2d Ed., London, 1873.

Chestnut-sided Warbler, devour a part and often the major part of the excreta at the nest. This is a very common practice



Fig. 118. A common scene at nest of the Chestnut-sided Warbler. The male brings food, while his mate, who is brooding, receives it into her own bill and passes it on to the children.

with the Warbler, Robin, Waxwing, and Vireos, but was only casually observed in the others.

The Robin has undoubtedly been seen by many in the characteristic pose shown in a number of the photographs, standing on the rim of the nest with the head erect, or inclined as if doting on her young ones and thinking what fine children they were, whereas this attitude is really one of sanitary

inspection. When an old bird of any of the species mentioned above has fed one of the brood, its duty is but half done; it pauses, bends over, and keenly scrutinizes each young bird in turn and every part of the nest. Shortly after being fed, the nestling becomes very uneasy, and raises its body as if to drop the sac over the edge of the nest. The old bird follows every movement, snaps up the package as it leaves the body, and either swallows it immediately or carries it off. When seen flying from the nest with

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head depressed, the Robin is usually engaged in errands of this kind. The Robins and Cedar-birds have frequently been seen to take the sacs from two or three birds in rapid succession, in which case they are always devoured on the spot. The Robin will often convey the package to any convenient perch, and, after examining it, devour a part, or reject the whole. While watching Robins from the tent, I have seen them carry the excreta thirty rods away before letting it fall or alighting to examine it, and have tried to find the sac but usually without success. One day I saw a male Robin drop the "white marble" in the grass about fifty feet from the nest, and proceed to peck at it. Upon going to the spot a little later I found the sac covered with dirt but not opened. It had a tenacious opaque white wall, was perfectly odorless, and contained, besides a few small pellets, a whole blueberry which had survived the digestive process. The actions of the old bird were thus explained. He was looking for food on his own account, but in this case missed it.

Not only are the young carefully tended in the way explained, but the old birds often put the head down in the nest and rummage about for any stray particle of food or fragments of any kind which it is desirable to remove. While standing at the nest they will sometimes pick energetically their own legs and toes, and the heads and bodies of the young, a very important function where the nest is infested with those minute swarming particles known as lice and mites. Every straw and fiber in the Cedar-bird's nest shown in one of the photographs (Fig. 50) was literally covered with parasites, in this case a species of mite which is a poor and degenerate relation of the



Fig. 119. Flicker cleaning the nest.

spider. When the nest or anything in it was touched they would swarm up the hand by hundreds, but they are barely visible to the eye, and apart from a slight tickling sensation between the



Fig. 120. Brown Thrush cleaning the nest.

fingers are scarcely felt. They do not seem to trouble the old birds much, but must give discomfort to the young, especially if from any other cause they happen to be weakly.

The cleaning of the young and nest is instinctive in a very large number of birds, and so also is the care with which they

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avoid any defilement of the nesting site. The use of the excreta as food, however, is not to be regarded as due to inheritance.

Much light is thrown on this question by the behavior of the Chestnut-sided Warblers, whose habits will be referred to again in the concluding chapter. Both sexes in this case fed, brooded, and cleaned the young and nest. The male regularly removed the excreta but was never seen to eat it. The female on the contrary often ate of it, and brooded so constantly that she was obliged to leave the nest to satisfy her own hunger. She would often be back in half a minute, having taken only a bite as it were. When the female had received the food which her mate supplied and had seen it safely delivered, she would inspect, devour everything which needed removal, and then continue to brood. If a sac should accidentally fall, she would snap it off the ground, return to the nest, and brood as before. At other times when the male approached she would stand aside and allow him to deliver the food and make the inspection. Twice I saw the male take a sac to carry it away, and the female snatch it from him, swallow it, and settle down on the nest. Again another sac was torn asunder, and each bird went off with a half in its bill. In a moment the female returned but without bringing food, showing that she had been satisfying her own hunger. This not only proves that the excreta is used as food but illustrates how the habit of eating it may be forced upon a hungry brooding bird.

Since digestion in the young is an imperfect process at best, it is easy to understand how any kind of pre-digested or partly digested food might be acceptable in times of stress when the staple article was not easy to procure. The fact that a bird only casually devours a pellet or swallows one and removes another is easy to understand. It is a question of the hunger of the moment, and another illustration of the economy which birds display in all such matters.

While the removal of the excreta is an instinctive act, the use of it as food is probably an acquired habit, the strength of which depends on the force of circumstances, and may be limited in some cases to one sex alone.

CHAPTER XIII

LIFE AND INSTINCT

I

FROM the earliest times the activities of animals or what they do has been a subject of universal interest, yet until recently accurate knowledge of animal behavior has made little progress, considering the richness of the field which is offered to the student, its singular attractions, and ever present opportunities.

It is easy, however, to understand why popular interest in natural history has not advanced our knowledge of animal life in a greater degree. The successful study of animal behavior requires continuous and exact observation, often extending over considerable periods of time, not to speak of thorough training in the natural sciences. It is true that in the analysis of the most elementary phenomena of life and action biology has not advanced beyond the stage of description and suggestion, but this should serve as an incentive to even greater care in experiment and observation in so wide and difficult a field. In the study of behavior there is certainly no danger of exaggerating the importance of scientific method. If only as a balance-wheel to speculation, both anatomy and physiology can do good service for the student of the animal mind.

The modern method of studying animals is to go to nature direct, to experiment, and to use every means which promises to yield valuable returns.

If the observer is properly equipped, he should be able to ascertain the facts and conditions of animal life with a fair degree of accuracy, but when he attempts to analyze his facts the

difficulties grow apace. From the operation of our own minds we infer by analogy what takes place in the minds of animals,—a form of reasoning which is apt to lead us astray, but since it is possible to study animal life only objectively and as it were at a distance, such a course is in some degree inevitable. It is best, therefore, not to press analogies farther than the observed facts will warrant. A good rule is to discard second-hand information, and to remember that isolated, disconnected, and therefore imperfect observations are often a fruitful source of false ideas. We must further guard against the popular tendency of reading into the actions of animals the whole gamut of human feeling and capacity, that fatal pitfall which claims so many incautious writers.

Life implies action and movement, and *response* is its most striking characteristic. The study of the animal which responds, and of the theater of its response—the world about it,—leads up to the most interesting if not most important study of all—the activities or behavior of the ‘living, going machine,’ and to the successful interpretation of behavior every science must be made to contribute.

That the movements of living things, unlike those of artificial machines, are mainly adaptive, or that they tend to promote their welfare or that of their offspring, cannot be denied. In some cases the responses of the higher animals are without doubt useless or indifferent, but it is obvious that in all important matters they cannot persist in a harmful course without serious results.

Every animal at birth inherits with its bodily organs the power to use them in a more or less definite way, and all the higher animals, as far down the scale as the insects at least, learn to do things in the course of their lives, and thus display a form of memory. Their equipment therefore embraces: (1) unlearned or inherited powers, and (2) learned or acquired abilities, which are the results of experience—often very bitter. The animal’s powers, in other words, consist of free gifts at its start in life, and of later acquisitions gained through its own efforts in the struggle for existence.

All animals, moreover, test their surroundings by a method of trial, and error or success, but differ amazingly in the ability to profit by the experiences thus gained. The lower forms act quickly, but with great uniformity; consequently they stumble through life until they finally pay the penalty of their mistakes and inability to learn. The higher animals make the same tests, but apply the knowledge thus gained by varying their conduct to meet the needs of the moment. They control their actions, exercise choice, and display originality, all of which are marks of intelligence.

In the catalogue of inherited powers, the first place (1) should be reserved for all the *general responses* or physiological properties of living things,—the activities of the cells, upon which the life and growth of the body depend; to these must be added (2) those direct, and remarkably uniform responses of lower organisms to light, gravity, pressure, and other forms of energy, which determine their orientation or general movements, and may be called *trial movements*, or *tropisms*, as well as the closely allied (3) *reflex actions*, or motor responses, and (4) the still closely related but more complicated and more variable responses, to which the name *instinct* has been applied. In the *voluntary* or *intelligent response*, which is far more variable than instinct, and often very complex, we pass the boundary line between hereditary possession and individual attainment.

The trial movements, or tropisms, play a great rôle in the life of the lower animals and plants, and physiologists have shown that many actions formerly ascribed to instinct can be resolved into a series of simpler tropisms (or reflexes, in the wider sense), the number of which is very great. Even the lowest beings in the living world respond to light and other forms of energy in a very definite way, and the kind of response depends not alone upon the nature and intensity of the exciting force, but upon the condition of the animal or plant as well, or the attunement of their bodies at a particular time.

In the nocturnal habits of the earthworm we have an excellent illustration of response to an external force. It remains in its dark burrow by day, and issues forth in the darkness of

night to feed. When stimulated by the light of returning dawn, it retires again to its darkened subterranean chambers. Experiment has shown that the worm responds to light of a certain intensity, even crawling away from the light of a dull day, but towards the much feebler light of an ordinary night. Such movements, which were formerly assigned to instinct, are thus seen to be prescribed by the direction and intensity of the rays of light. That such responses are adaptive, or useful, is shown by the fact that it is only "the early bird" that catches this worm.

The attraction of the candle for the moth and other night-fly-ing insects is proverbial, and, as often happens, they will return to it again and again until, singed in the flame, they fall to the floor. In this case experiment has also proved¹ that the moth always flies towards the source of light, and that it is more sensitive at night. Moths pass the day in a kind of sleep, but become very active at the approach of dusk.

Earthworms, as well as many other animals, also creep into the crevices of solid bodies, which for the time holds them like a trap. They will crawl the whole length of a crevice before leaving it, and the response in this case is not to light, but to the mechanical friction of a solid body against their skins. These are but a few of hundreds of illustrations which could be given of the tropisms, or trial movements of an animal, which are influenced by the direction and intensity of light or by energy of some other form. While much still remains to be explained, this is a step in advance of the former custom of ascribing all such actions to "blind instinct." Changes in the nervous system may determine the character of the response, but the fact that the animal moves at all is due to an outside cause.

Physiology has also given us the term *reflex action*, which was first applied to vertebrates, and suggests a comparison between a mirror and the spinal cord. This was supposed to receive sensory impressions from the surface of the body and to

¹ See especially the *Studies in General Physiology* of Professor Jacques Loeb. Chicago, 1905.

reflect them back on the muscles, which were made to contract. It thus implied a complicated mechanism of sense-organs at the surface of the body, central cells in the cord, and conducting nerves. The closing of the eyelid in response to a sudden movement of any object towards the eye, and the adjustment of the pupil by which the intensity of the light which falls upon the retina is regulated automatically and with wonderful precision, are typical illustrations of adaptive or useful reflex responses. The tropisms usually involve more or less complicated reflex movements, and between these forms of response no sharp distinctions can be drawn. Moreover, when reflex action is reduced to its essential qualities,—the receipt and dispatch of impulses,—we must allow that the same type of response is seen in plants as well as in the simplest unicellular animals, in which the refinements of an elaborate system of conducting nerve-fibers and distributing centers are unknown. In this wider sense the simple, and uniform reflex response may be regarded as the unit, as well as the most primitive type, of activity.

For a still more complicated kind of behavior metaphysics has given us the venerable term *instinct*, which has proved a veritable apple of Sodom, and has been the source of more ineffectual discussion than almost any other subject with which modern biology has to deal. It is properly applied to a complicated series of actions, which are useful to the individual or to its progeny, but which are performed without any foresight of the ends attained or the choice of means. The performance of the most complex instincts, as in building the nest and caring for the young, calls into play the whole body with all its powers, rather than single parts or organs alone, in this respect agreeing with tropisms but differing from most reflexes in the narrower sense.

We have already seen many illustrations of the feeding instincts displayed at the nests of many wild birds. Old and young seem to move like one being, so nicely adjusted are the give-and-take reactions between mother and child. Such a bird as the Cedar Waxwing, though blind at birth, possesses the senses of hearing and touch. When stimulated by hunger,

sound, or vibrations of any kind, it rises upon its pliant stomach as upon a pillar, and with neck up-stretched, trembling like a tuning-fork, it opens wide its mouth, thus exposing its sensitive throat like a pink, yellow-rimmed target to the eye of the parent. The whole body is taxed in the performance of this act, which is done to perfection for the first time and without a teacher. It seems to be a typical reflex response, as automatic as an electric bell. Press the button,—that is, jar the limb, or make any kind of sound,—and up goes the head again and again, until fatigue comes to its aid. That the act is adaptive or purposeful the sequel presently shows. When the parent is at hand with food in its gullet, it immediately tosses back its head; visible waves of contracting muscles are seen passing upward from the invisible stomach, when it regurgitates a crushed berry or insect; then bending low it aims for the center, placing a few drops or pieces well down in the throat. Here another “spring” is suddenly touched, and note the result. The swallowing reflex is started, and the nestling enjoys its first meal. By a reversal of the process already witnessed in the adult, the food is carried downward to the stomach, where a complicated series of changes awaits it. The comparison of such instinctive acts in the nestling, to a “chain” of reflexes would seem to be justified.

In this case the actions of the parent bird imply a long series of nicely related and orderly movements: the search after prey and its capture, the varied and often strange treatment which this sometimes receives, its transportation to the nest and disposition among the young,—the general trend or form of which may remain the same from generation to generation,



Fig. 121. Cedar-bird about thirty-six hours old, blind and naked; characteristic response to any sound or vibration. Notice that the bird rests on its pot-belly, and uses both wings and legs for support. Enlarged to life.

while in minor details it is subject to endless change. No doubt many reflexes are called forth by the sight of food, of the nest,



Fig. 122. The Red-shouldered Hawk often stands on the toes of one foot, with the 'heel' or end of the bare shank of the other resting on the perch.

and the quavering young; but, as in the case of hunger and other forms of desire, the real promptings to such behavior, which are needed to weld the links of the chain, seem to come from within the body and not from without. In feeding her nestlings, the mother seems to be really pleasing herself and satisfying her keenest desires, which are, however, intensified at the sight of her young and at the sound of their cries. When a distinction is sought between

reflex action and instinct, we must repeat that while the power of coördinated response is the chief hereditary gift in both cases, in the latter it may be called forth by internal states or emotions as well as by external agents, and is more complex and variable in character.

In the complex behavior of the wild bird, we see the outlines

firmly drawn in by instinct, but altered and refined in many places by intelligence, and paralleled and shaded at every point by reflex action or the power of motor response. It does not seem probable that such actions can be completely resolved into a number of simple reflex components, but even should this be done the historic and much-abused term *instinct* could still be used to advantage.

Many instincts mature at birth, while others are delayed until needed; some are called forth but once only, others repeatedly. As we have seen (in Chapter I.), the parental instincts are periodic in appearance and serial in character.

The catalogue of instinctive acts which even the higher animals perform is so great that one is not at a loss for illustrations. To those already given I will now add the following, from animals both high and low in the scale.

When the spring comes, the young bird, who returns to the place of its birth, is prompted to find a mate, and with her soon begins to build a nest. Though unattended by instructors, and unprepared by practice, it uses the inherited tools of its guild—bill, breast, and feet—with nice precision, and be it Oriole, Robin, Flycatcher, or Vireo, follows with wonderful closeness the type of architecture which its ancestors have used for ages.

Why does the Robin, in its first attempt at nest-building, begin by laying a foundation of dry grass or stubble, and add to this mud softened with water, which it then heaps about its breast, and with repeated turnings and shakings gradually molds into a symmetrical cup, often selecting a rainy day for the purpose, and why does it finally finish the whole with a lining of fine grass? One might as well ask why the Robin lays blue eggs, or why it utters its well-known call. It acts in these ways because it must, because Robins have been doing these things for hundreds of generations. It not only inherits tools, but a certain aptitude for their use. Its organization compels or determines its actions.

If the young of a viviparous shark be taken from the body of its mother and cast into the sea, they will swim off, without

previous experience or practice,¹ as some water birds have been known to do at the very moment of breaking the shell. There is nothing more remarkable about this than that the swarm spores of a Protozoan should swim at the moment the mem-



Fig. 123. Young Red-shouldered Hawk spreading about its prey, which is held in its talons.

brane of the mother cell which encloses them bursts. Indeed, their movements may be most active long before they are set free.

Why does the young Hawk (Fig. 123), when introduced for the first time to prey which is alive and can move, crouch, rivet

¹ See Audubon, *Ornithological Biography*, vol. iii., p. 52.

its eye on the victim and, like a flash, strike it with its mailed foot; then squealing all the while, spread wings and tail to the ground, thus making a complete enclosure about the quarry, with only one way of possible escape, that beneath its bill and watchful eye?

Again, how is it possible for hive-bees, working in the dark and all crowded together, to produce the exquisite comb, composed of a double layer of regular hexagonal prisms, which will contain the greatest amount of honey with the least expenditure of wax, for the making of which precious honey must be sacrificed? Or, again, what prompts certain ants to capture and bring into their nests ants of other species which are held as slaves, and in this capacity not only procure food for their masters, but even feed and clean them? The worker bee and the worker ant are sterile, and therefore unable to transmit anything which they either inherit or acquire.

How is the larva of the butterfly or moth able to spin its cocoon? It does it alone, but once in its life, and does it perfectly.

No learning of such initial actions is required or possible since all this has been attended to, as one might say, centuries before the animal was born. All such instinctive activities are spontaneous, and when the right button is pressed, or the right stimulus applied from within or without, the reaction follows as a matter of course. Of course the Robin must knead and mold its rude nest-materials of mud and straw; of course it must lay blue eggs, and after incubating them, feed and rear its young. To be denied the privilege would cause sore distress. Had its ancestors been Cowbirds, it would have made no nest at all, but filched another's, and foisting its eggs upon some simple-minded nurse, shirked the duties of parents to their offspring. The Cowbird was thus very early to enter the field of experimental psychology.

Every bird must follow the laws of its nature, and its inherited instincts are no more wonderful than its inherited organs,—its vocal cords, its keen eyes, and its wonderful feathers.

II

In popular language, by the "habits" of an animal, we mean its manner of life in general, while a *habit* in the restricted sense is something which the animal learns or acquires. It is associated with pleasure, and by frequent repetition may become fixed or stereotyped.



Fig. 124. Cock Robin taking aim.

Under some conditions habits are formed with surprising quickness. The habit may be of trifling significance and have only a brief reign, but no habits are absolutely rigid, and the genesis of all is probably the same,—pleasurable consequences following repeated actions which may be forced or accidental. The result is in all cases similar,—a mental association of certain things with certain actions.

While watching hour by hour the Robins described in Chapter IV., and recording their visits to their young, I began to notice on the third day that the male usually approached on the right side of the nest—that is, on the observer's right as he



Fig. 125. Inspecting the household. The female approaches on the left.

stood facing it, while the female frequently came to the back or on the left. From that time I recorded the manner of each approach, and found that the male invariably came to the right side, and hopped down the limb to his nest.

In the table given on page 206 in which the visits of both birds are recorded for two consecutive days, R is for the right, L for the left, and B for the far side of the nest with reference to the tent, while the dashes represent visits the character of which

was undetermined. Each sign represents a visit to the nest at which food was usually served.

July 27th. Third day of observation—6½ hours.	{	<i>Female</i>	R R — R R L B R R R R R B
			R L — — L R — — — — —
			L — — R
July 28th. Fourth day of observation—4 hours.	{	<i>Male</i>	R B R R R R R R R R — R R
			B — R R R — — R R —
	{	<i>Female</i>	L B B L B — B — — — B B
			— — —
		<i>Male</i>	R R R R R R R R R R R R R
			— R R R

For the fourth day I have no record of the female approaching by the right side, and no record of the male coming in any other way. On the two following days the female did not appear, and, as I had reason to believe, was engaged in building a new nest. The male at this period always approached his nest in the habitual manner. Now whether the male bird had formed this habit shortly after the nest was built or shortly after the nesting bough was removed is of little consequence. At all events a definite mode of behavior had developed in a short space of time. On the fourth day the young had to be brooded often, owing to the heat, which accounts for the apparent inactivity of the female in providing food.

Birds form definite habits in the manner of approach to the nest, entering on a certain side, or flying to a certain twig, following the path suggested in the first instance by convenience or dictated by caution. As we have already seen (in Chapter XI.), the habit may arise at the very beginning of nest-building. A pair of Red-eyed Vireos with whom I spent parts of three days followed a definite course in approach with surprising regularity. They would fly to the main branch, hop along toward the fork in which the nest was suspended, and finally perch on a small convenient twig just over their young. Out of sixty recorded visits they deviated from this habitual method but three times, and then only before they had recovered from their first feelings of fear. In this case the nesting

branch had been drawn down about a foot by means of a cord, but was not otherwise disturbed.

In sitting over the eggs or young, birds quickly acquire the habit of facing the same way, in the direction of habitual approach, and in going to sleep, of twisting the head habitually to the same side.

In cleaning the nest the attitude is frequently the same in successive visits, the birds often clasping the same twigs, so that a number of photographs of the act taken without moving the camera may be so nearly identical that only the most careful inspection will reveal the least difference in pose or position.

While engaged in studying some Redwing Blackbirds in July the weather was hot, and the young had to be brooded almost constantly. The female would sit on the nest, often with back to the tent, with feathers erect and mouth open in her efforts to keep cool. Suddenly the shriek of a steam whistle sounded the hour of noon at a mill scarcely three rods away. It startled me, but the bird did not budge a feather. It is not difficult to imagine that her first experience with this instrument of torture was quite different in its result, but the case illustrates the ease with which birds become quickly accustomed to strange and uncouth sounds, when, as sometimes happens, they place their nests in a saw-mill a few feet from the buzzing saw or above the grinding trolley cars of a city street.

Every animal must adapt itself in some measure to changes in its surroundings, and with birds this necessity is well expressed in the nest, the position, materials, and construction of which are subject to incessant change, and in the diet. The change in nesting habit may be slight or of a very marked character, as when the common type of architecture is abandoned, or a distinct nest-structure wanting. Only a single example of change in nesting habits need now be considered since the facts are matters of common observation.

The Swift of this country is often quoted as one of the most remarkable examples of birds whose nesting habits have changed in recent times. Formerly breeding in hollow trees and still doing so in places remote from mankind, it now attaches its little

wicker crates to the inside of chimneys. From the standpoint of the Swift the change has really been very slight, and had it not become so widespread it would have attracted little attention. This bird was probably drawn to the town and open country by the greater abundance of its insect prey, and to the



Fig. 126. Male Redwing Blackbird cleaning the nest.

mind of the Swift a chimney cannot be very different from a hollow tree. Its instinct probably does not lead it to select a dead tree for its roosts or nests because it is a tree, any more than it leads it to prefer a sycamore to an oak. What is probably inherited is the tendency to seek a dark or cavernous place with easy entrance and exit. The chimney which emits no smoke in summer and usually stands in the open, fulfils every requirement in places where hollow trees are scarce.

The Swift is yet capable of adapting its needs to conditions far more unlike those of the ancestral tree, and cases are occasionally reported in which it has nested in barns and other dimly lighted buildings.¹

In at least one respect birds resemble men in their ordinary



Fig. 127. Male Redwing Blackbird cleaning the nest; photographed under the same conditions as Fig. 126, and illustrating the formation of habit in the daily routine.

building operations. They make use of the materials at hand, but in the selection of the site for the nest many seem to obey no rule, being ever on the alert to adapt themselves to their lot, and a habit once formed often leads to a steady line of conduct.

The diet of an insectivorous bird is extremely varied at all

¹ See p. 114 of the first edition of this work.

times, depending much upon the locality and the season of the year. While a few kinds of insects may be avoided because of a repugnant taste, they capture, as a rule, whatever comes in their way. The Robin commonly brings to its nest grasshoppers, crickets, katydids, and angleworms, because in its cus-



Fig. 128. Female Kingbird balancing herself with raised wings while feeding young.

tomary manner of search it finds and is able to secure these forms in abundance. The Kingbird, which takes most of its prey on the wing, discovers a far greater variety. When certain species of insects are abundant, they are often eaten by many birds who under ordinary conditions would never touch them. Thus during a plague of Rocky Mountain locusts which visited the Western States, these insects are reported to have been eaten

by nearly every bird in the region, and to have served as a staple for most of the species. Birds of prey such as the smaller Hawks and Owls devoured them eagerly. The food habits of most birds are exceedingly plastic and liable to sudden change under the spur of necessity.

The simplest acquired powers, which are the fruits of ex-



Fig. 129. Male Kingbird seeing a cicada safely down a hungry throat.

perience, are the marks of intelligence also. As a result of trial, error, or success, the animal soon learns to do certain things; it develops a memory, and forms habits.

The young and inexperienced chick, at birth or shortly after, will peck indiscriminately at all sorts of objects, as the nestling bird responds to sounds of every kind; but it soon learns to

select agreeable insects and dabs of meal, but to reject shining tacks, burnt match ends, and stinging bees. It learns to associate a definite experience with a definite object, and by controlling its actions to profit by the experiences thus acquired. In other words, it displays associative memory, which marks the dawn of intelligence, and, as some students believe, of consciousness also. Any animal which can learn or be taught accordingly possesses memory of this kind.

The wild bird learns to eat certain things, to avoid certain enemies, to start at certain sounds, to ignore others; the young Kingfisher even acquires the habit of walking backward (see Chapter X.), while its instincts lead it to walk forward. It learns to drink by first getting its bill wet, possibly by picking off drops of dew from the grass, and by raising its head starts the swallowing reflex.

The mental life of animals is like a piece of fine weaving, in which the original strands have been so often replaced by others of different quality that the texture and pattern have been essentially changed, and this change is going on all the time. In animals standing as high as the birds, experience quickly modifies the instincts, which, as we have seen, may be changed or virtually replaced by habits. It should not therefore surprise us if a bird's second nest were more nearly perfect than its first, or if the third should prove better than the second, but this would also depend upon other conditions.

The power of forming habits is a sign of intelligence, but not necessarily of reason in any of its higher grades or levels. The intelligence may be a small grain and never destined to grow into a flourishing tree of knowledge, but it must exist along with the power of putting any experience to profitable use.

The habits acquired by one generation are probably never handed on to the next, but this is a subject about which the dust of argument has not yet cleared away.

The life of birds is one of instinct irradiated by gleams of intelligence. Their mental faculties exhibit a wide range of gradation from excessive stupidity to a fair degree of intelligence, with strong associative powers,—rarely if ever the association of ideas

but of things with actions,—and often with wonderful powers of imitation.

In the order of evolution the simple reflex responses were the precursors of instinct, and instinct of intelligence. The degrees of the latter are not sharply defined, and it is possible that all types of response intergrade. Yet, according to the later views of evolutionary progress, the forward steps may be rapid as well as slow, and intelligence may mark one of those sudden advances, which have appeared in the past history of life on the earth.



CHAPTER XIV

FEAR IN BIRDS

BIRDS as a rule are possessed of fear, which is primarily an instinct, but, as we shall see later on, many species in their natural adult state are entirely devoid of this sense. With others it may wax or wane according to their environment or individual experiences. Again, the nature of the fear manifested varies with age or the period of life. It is a generalized sense of fear, or fear of the strange and unusual, which comes over the young bird, while later it learns to dread particular objects or sounds with which some bitter experience is associated. Furthermore, the time of the appearance of the instinct varies in different species, coming late in some and early in others. Generally speaking the manifestation of fear is well timed, and is an adaptation for the good of its possessor.

Let us first see how fear enters into the life of the young. Birds are sometimes roughly classified into altricial species, which feed their young for days or weeks at the nest, and præocial birds, whose young are born clad in soft down, and are able to walk, run, or swim at once or very soon after hatching. The Altrices, like the Robin, Woodpecker, and Humming-bird, are hatched from eggs which are small in relation to the size of the parent, and the young are at first blind, helpless, and more or less completely naked. In all such the nest is only a temporary home, but is often very elaborate, while the instinct of fear is delayed or deferred until the time of flight, a period varying from a few days to three weeks or more. The Præoces lay eggs with big yolks, upon the stored energy of which the unhatched young subsist until they step forth into the world, seeing, able

to walk or swim, and in some degree their own masters. The common domestic fowls, Partridges, Ostriches, Geese, Loons, Plover, and Snipe, are some of the better known representatives



Fig 130. Brown Thrush startled while at nest : attitude of keen attention.

of this group, but the dividing line is never sharply drawn, and there are innumerable gradations between the extremes in either class. In the præcocial birds the feeling of fear is either present at birth, or appears in a very few hours or days.

As an illustration of the development of fear in the altricial kinds, one might select any of the common passerine birds, Thrushes, Warblers, Finches, or Flycatchers, but we should bear in mind that the development of this instinct is not always uniformly timed, even in the same species. We will choose the Catbird, the Chestnut-sided Warbler, and the Kingfisher.

When I first camped beside a Catbird's nest (No. 6 of table, Chapter I.) in June, the young, who were then about a week old, were incapable of fear. They would shift about the nest to get into the shade, pant, and erect their growing head-feathers. When a breeze rocked the cradle, or a Redwing Blackbird sang his *conquer-ee*, or the parent came with meat or fruit, they stretched necks, opened mouths, each struggling to get some advantage over the other, and uttered their sharp *tsit! tsit!* notes. You could handle them at will; they were absolutely fearless. If such a nest is overturned they will cling to it but never cower or crouch.

As we have seen, the clipping of a leaf at this nest two days later sent them off in a panic, and all hurried to the nearest cover. Should you succeed in catching them under such circumstances, which is doubtful, and try to replace them in the nest, they will pop out repeatedly as if mounted on springs, and if you try to hold them in the hand they will struggle, squeal, and fairly shriek in their endeavors to escape. They are now covered with a coat of slate-colored feathers, but fly with difficulty. When placed on open ground, they hop off at once toward the nearest bush. No greater change in the behavior of a wild bird is ever witnessed than that which the sense of fear brings to pass.

I have seen a young Chestnut-sided Warbler jump out of its nest, when unable to stand erect and much less to use its wings. In this case the pin-feathers of the wings had barely burst, and the body was nearly naked. When the bird was returned to its nest, it refused to remain until the operation was many times repeated and it was finally overcome by fatigue. I have known the young of the Redstart to leave the nest remarkably early, but the case just recorded appears to be somewhat exceptional.

The instinct of fear comes with a certain maturity of the nervous system, with comparative suddenness, as we have just seen, but is usually timed to correspond with the development of the wing-quills and the power of flight.



Fig. 131. Young Kingfishers twenty-four days old. They are capable of flight but show no fear.

At the age of twenty-four days the Kingfisher is in full feather, but shows no fear. He will perch comfortably on your hand or shoulder, and pose in any desired position, as the photographs made at this period will show, but the instinct soon appears after this stage is passed. In from twenty-four to forty-eight hours later, when these birds not only possess the power of flight but use it at the first intimation of danger, their docile nature has completely changed. With them the late development

of this instinct is most opportune, since they are not tempted to leave the security of their tunnel in the ground until they can make long excursions and follow their parents to the favorite fishing grounds.



Fig. 132. Red-tailed Hawk, four months old, in attitude of fear. The young bird at the nest will spread its wings as well as erect its Elizabethan fiill, and hiss at intruders.

Turning now to the præcocial birds, according to the best testimony, fear in the domestic chick hatched in an incubator is at first very slight, and is soon checked by contrary impulses such as to nestle in a warm place, unless the instinct be brought into immediate exercise.

Mr. Charles A. Allen says that the newly hatched young of the Black Duck (*Anas obscura*) show no fear, but will "cuddle

under one's hand very confidently." I once saw a nest of this species on the shore of Lake Champlain, near Burlington, Vermont, on the very verge of a high, overhanging cliff. It was set against the stems of a slender shrub, the pulling of which would doubtless have precipitated the entire clutch fifty feet into the water below. A little delay in the instinctive reaction of fear could hardly come amiss to young in such a nest. On the other hand when the ducklings have been led to the water no birds show a keener sense of fear than they or respond more promptly to the alarm signals of their parents. I was greatly impressed when a boy at the sight of a Black Duck leading her trim little fleet of yellow sail up the mouth of a small sedge-bordered stream. The old bird quickly gave the alarm, rose, veered, and flew towards the river, while the young scrambled to the bank and hid in the rushes. I hunted long but succeeded in finding only one that lay flat in the marsh and kept perfectly still, true to its inherited instinct. These ducklings had not been afloat many hours, and had this action been repeated before, the lesson could not have been taught, since, as we have seen, the young under such circumstances are left to their own devices.

I have seen a young chick while feeding quietly close to the house suddenly turn its head, look straight at the zenith, and then run off in a panic of fear. Looking up also I saw a Hen Hawk sailing aloft like a toy kite, a mere speck against the blue heavens. I think it probable that the bird got an alarm signal from some other fowls in the yard; at all events it knew where to look, and its response was not slow. This chicken may have been three weeks old, and so had ample time to learn its lesson, if such it was. Had the dark object been a paper kite, it is not likely that the fear evoked would have been appreciably less.

In altricial birds the sense of fear usually comes, as we have seen, with the development of the flight feathers, but it is often premature, thus indirectly causing the death of thousands of birds every year. In July and August how many helpless Sparrows and Thrushes are found on the ground, having left their nests too early! Sometimes they tumble out by accident,

are drawn off by hunger or are blown out in a gale, but I believe that by far the greater number of such strays are driven forth by fright, and when this perilous step has once been taken



Fig. 133. Young Cowbird comfortably filling the nest of its foster parent, whose children it smothered: fearless, though nearly ready to fly.

it can seldom be retraced. The young of such birds as the Wilson Thrushes, whose nests are on or near the ground out of the reach of storms, are often found in this predicament.

It is an interesting fact that the huge pot-belly of the young altricial bird has a use quite apart from the function of digestion. It anchors it to the nest, and as in the modern "Brownie" keeps it right side up. The pliant viscera conform to every movement, and form a central supporting

pillar long before the legs can sustain the weight of the body. (See Fig. III.)

Many immature birds which I have watched at the nest show no precise powers of discrimination in any direction. You will see them respond as promptly to the flutter of a leaf or the

call-note of any passing bird as to their own mother's voice, but a more curious spectacle may be witnessed when a fledgling of one of our common species, like the Baltimore Oriole, climbs to the top of its nest. All the others immediately salute it as if it were an old bird, and with open mouths beg vainly to be fed. If a young bird within a day of taking flight cannot distinguish one of its brothers from its mother, it can hardly be expected to "know a hawk from a hand-saw," or an enemy from a friend.

After taking flight, the young of altricial birds are fed by one or both parents for a period of days or weeks,

and much is quickly learned by imitation and individual experience. Their ingrained sense of fear becomes in the course of time gradually specialized in certain directions. Fear of man, guns, hawks, snakes, cats, and the various agents of destruction with which each species must contend in the course



Fig. 134. Young Cowbird on nest of Magnolia Warbler in which it was reared.

of its life, seems in every case to be acquired or learned rather than inherited.

The instinct of fear seems to be longer deferred in the Cowbird than in many other species. This was true of a bird which was nursed by a Magnolia Warbler (see Figs. 133, 134), whose nest



Fig. 135. Young Cowbird, being nursed by a Chipping Sparrow, whose own young it had destroyed.

it completely filled. Standing with erect feathers on the rim of the nest, he would squeak and call vehemently for his foster parents. I took from beneath him the dried mummy of a little Warbler and one addled egg, which illustrates the advantage nature gives this bird over his competitors in early life. He showed no fear, but clung like a monkey to the nest, while I carried the branch several hundred feet to find a quiet place out

of the wind. In this instance I did not see the Warbler, but am fortunate in being able to illustrate, in the devotions of a Chipping Sparrow to another Cowbird (Fig. 135), the strength of those parental instincts, which often demand satisfaction at whatever



Fig. 136. Cock Robin startled while at nest by a quick, decisive alarm call from his mate. His head shot up like a flash, and in a moment he was off.

cost. This bird's family was also sacrificed, but in favor of a pair of Song Sparrows, from whose nest I had taken the egg.

Many birds have alarm calls or signals of distress, which attract or arouse other species, as every one knows who has studied birds in the country. When a Robin hears the alarm call of his mate, his head goes up instantly, and he stands for a moment with outstretched neck, listening intently to see if he is needed. I was fortunate in catching the male bird at the

nest in just this attitude, expressive of attention and wariness, bordering on fear. (Fig. 136.)

A hawk, owl, crow, cat, snake, or any well-known or dreaded enemy of birds will set the community in a hubbub in a very short time. Birds of other species hurry to the scene out of sympathy or curiosity, as some would say, but probably more from instinct of a different character. The smallest spark often kindles the largest blaze. Thus while passing through a pasture last June I happened to encounter a Robin with mouth stuffed with food, as if on the way to her nest. She at once set up a loud cry, and mounting the bare branch of a dead apple tree, in five minutes drummed up eleven different birds, among which I recognized the Baltimore Oriole, Brown Thrush, two Catbirds, Chestnut-sided Warbler, Red-eyed Vireo, Maryland Yellow Throat, Song Sparrow, Chickadee, the Redstart, and a Goldfinch, many of which became excited and joined in the general outcry.

To return to a subject which has been mentioned more than once in this work,—the brooding instinct of the Flicker furnishes a beautiful illustration of how the strong sense of fear may be checked by a stronger and contrary impulse. When a nest of these birds was discovered on the third of June, a gentle *tap-tap* on the hollow apple tree was quickly answered; a polished chisel-shaped bill was thrust through the window and quickly withdrawn; another *tap*, and the graceful form of this Woodpecker appeared, and spreading to view the black, white, and gold of her ornamental quills, she went off like a flash, without a sound. There were seven eggs in the nest, and fear was still in control.

Compare her actions a week later, when there were young about four days old. The tree giving no sign of life on the morning of the eleventh day of June, I cut a square block from its side well below the circular door which had been already chiseled out by the bird (Figs. 43, 137), and was astonished to see the Flicker sitting motionless as the Sphinx. She had not moved a feather, not even to shake off the sawdust which had rained over her handsome back and head. I stroked her with my finger, enclosed her in my hand, lifted her up, and unfolded

her lovely wings, but there was no unfriendly response. She was absorbed, and clung to her young like iron to a magnet. No



Fig. 137. Male Flicker regurgitating the food at nest-hole, before entering to deliver it. The closed artificial window is shown at the lower end on the right.

better illustration could be given of the brooding instinct at the flood, blocking and completely banishing the sense of fear

It is difficult to leave this nest without lifting the curtain for

a moment to reveal a picture of unusual interest. Under this bird lay five blind, naked, long-necked, taper-bodied creatures, heaving and swaying like a bed of writhing serpents, suggesting the true relationship and origin of birds.

Five days later the Flicker had recovered her sense of fear, and was exceedingly wary in all her movements. The young



Fig. 138. The window open, showing the Flicker pumping food into a nestling.

were fed regularly by both parents at intervals of one half hour, and by regurgitation, on a grayish paste which may have been pulverized ants' "eggs," and suggested a cooked cereal of the breakfast-food variety. One of the illustrations (Fig. 138) shows this bird clinging to the wooden walls of the nest, head downwards, and pumping this concentrated mixture into the throat of an excited nestling.

The preceding pages on this important and difficult subject may be summarized as follows: The instinct of fear is inherited, and often delayed, where it is a special adaptation, not only leading the young, as Lloyd Morgan remarks, to accept a foster parent and not to shrink from her, but what is more important, keeping the young in the nest, barring accidents, until they can in some degree help themselves. Fear of particular objects is learned, or becomes grafted on to the original stock. The instinct may gather force or disappear, at least in adult life, according to the nature of the environment and the new habits formed in consequence. The strongest sense of fear may be partially or completely blocked by the brooding and other parental instincts. The instinctive basis of fear is apparently handed down from generation to generation, but in the life of the full-grown bird it is probably largely replaced by habit or the formation of associations. The innate or latent capacity remains, but the definite association of certain actions with particular objects or experiences is probably handed down by tradition rather than by heredity.

CHAPTER XV

TAMING WILD BIRDS WITHOUT A CAGE

MANY illustrations could be given of birds which in most parts of their range are wild or shy while in others they are very tame, and the same principle underlies them all. Wildness is due to fear, which is partly inherited and partly learned by experience with this wicked world. Tameness, on the other hand, comes with the casting out of fear, and may be brought about by the formation of new habits which are either spontaneous or forced.

The House Sparrows of the Tuileries, and the pious Stork of Holland, Germany, and France, are familiar examples of birds whose near or remote ancestors are shy and wary. The Stork when migrating in vast flocks along the borders of the desert and in the valley of the Nile is wary and hard to approach, yet it comes with confidence to the village and town, builds its nests upon housetops and steeples, and struts about the streets and door-yards in search of food.

It would be interesting to know how long the Doves of Venice have enjoyed the freedom of the Piazza del Marco. They are probably the best fed pigeons in the world, and few hours pass in the course of the day when their guardian, the vendor of sacks of corn, is not surrounded by his flock. They will alight all over you, and take the grain from hand or mouth. The Pigeon, it is true, has been long domesticated and responds more readily to friendly influences than the wild stock from which it has sprung.

Strange and possibly true stories are told of persons who have won the confidence of beast or bird. The wild bird responds to their call, and the quadruped comes forth from his den and

takes food from their hand. Such persons are popularly supposed to possess a mysterious power of fascination or a superior knowledge of woodcraft, but all this belongs in the catalogue of vulgar errors. It depends less upon the individuality of the person than that of the animal. Individual variation knows hardly a limit, whether in man or beast. Some birds are naturally tame and confiding, while their next-door neighbors of the same kin and living in the same field may possess a temperament of such an opposite character as to baffle every attempt to dispel their fears.

The power of remaining motionless like a stone or stump in the woods is often enough to win the temporary confidence of both mammal and bird, and many will doubtless recall illustrations of this fact from their own experience. This suggests an early episode which impressed itself rather strongly at the time. With raised fishing-pole in hand I was sitting quietly by the river, possibly watching the common sunfish or bream standing guard over their nests, which they defend with such fiery pugnacity, when I suddenly had a "bite." Looking up, I saw a Kingbird comfortably perched on the end of my rod. He doubtless had a nest in the alders close by.

It is easy to conceive a state in which all animals would be tame, but it would not be the state of nature known to us which has developed under the laws of battle, the survival of the strongest, the wariest, the best protected or concealed, or the most intelligent. The higher animals either prey on one another or on the helpless invertebrates, or are preyed upon, and with most, tameness would soon lead to extinction. Wildness or wariness is not only the law of their nature, but the very condition of their existence. The animal which fails to profit by experience, or at least to the extent of learning caution, and thus displaying the rudiments of intelligence, must go to the wall, unless the conditions of its life are exceptional or nature grants it some extraordinary favor in the form of instincts, great reproductive powers, or protective coloring.

While most animals are wild in the state of nature and many are almost untamable, a comparatively large number

submit to the taming process, and a few become tame in the natural state. Whatever principles of evolution shall eventually prove to be true, we may safely regard the higher vertebrates which are now tame in their natural state as the descendants of wild ancestors.

As a rule, no wild mammal or bird approaches man without some inducement. Unless some other instinct be aroused, it comes, if at all, to defend or feed its offspring, to appease its



Fig. 139. Red-eyed Vireo cautiously approaching her nest. Compare such attitudes with Figs. 60-63, which express no fear.

hunger, or in very rare cases to find protection from danger. The taming process depends, as we have just seen, upon the ability to form new associations, and may be brought about artificially by restraint as when a wild animal is caged and new habits are, as it were, forced upon it, or by means of strong lures. Of the latter, one of the best is food in the presence of hunger, but the strongest of all are the young at a certain stage of growth. In order to tame a wild animal without recourse to restraint there must be some means of breaking the ice, or beginning a course of instruction, by chaining it to a fixed point. In case of birds with young the invisible chain is parental instinct, which inhibits fear and holds the animal to a given spot. We

will attempt to analyze the taming process by the use of food and young birds as lures, and finally consider the similar experiments which nature occasionally conducts independently and on a larger scale.

I throw some cracked corn out of my window, and it is soon



Fig. 140. Male Red-eyed Vireo prepared to inspect and clean nest. Notice that in this series—Figs. 61-63—the birds uniformly occupy the same perch.

discovered by the ubiquitous Sparrows. When they see me standing behind the pane they are afraid to approach, but they are also hungry. At last the impulse to get the food overcomes their fears, and they are rewarded by the feeling of pleasure and satisfaction. When they come repeatedly, each time reaping a reward without evil consequences, a new habit is gradually formed by the repetition of the act. The pleasure of getting food is gradually associated with flying to a certain spot in the

presence of objects which in the course of time become familiar. If the contrary impulse, due in this case to hunger, is sufficiently strong, the process may be carried forward step by step until the birds come to the hand for food. With the gregarious Sparrow, however, life in a populous town is usually too complicated to admit of carrying out the experiment with success in any reasonable time.

There are many species which respond more readily than the wily Sparrow, such as the Chickadees and Nuthatches, the Wild Goose and the Canada Jay. The Chickadee has to work harder for a living in winter than the Sparrow, is far less gregarious and wary by nature, and is seemingly endowed with a keen sense of curiosity. The little Tits or Chickadees become very tame when hard pressed by hunger in the remote woods, and I have no doubt that the following account, which was given to me by a man who worked at a woodchoppers' camp in New Hampshire during the winter, is strictly true. He said that at meal times the Chickadees would come about and pick up any crumbs that were left over or were thrown to them, and that they soon became so bold as to alight on the hand, or hat, and even to take pieces of bread from the mouth; that he would often amuse himself by trying to "close over them" with his hand, and that while they were usually too quick for him, he had caught them in this manner.

The familiarity of the Canada Jay or Meat Bird is known to everybody who has hunted or camped in the northern woods; its fear is allayed by hunger even more promptly than in Chickadees and Nuthatches. Audubon says of these birds that "when their appetite is satisfied they become shy, and are in the habit of hiding themselves among close woods or thickets; but when hungry they show no alarm at the approach of man." While his friend was fishing in a canoe on one of the Maine lakes in the summer of 1833, "the Jays were so fearless as to alight in one end of his bark, while he sat in the other, and help themselves to his bait. . . . The lumberers or woodcutters of this State, . . . frequently amuse themselves in their camp during the eating hour with what they call 'transporting the carrion bird.'

This is done by cutting a pole eight or ten feet in length, and balancing it on the sill of their hut, the end outside of the en-



Fig. 141. Male standing at nest after having fed his young. Notice the characteristic instinctive pose of one of the fledglings.

trance being baited with a piece of flesh of any kind. Immediately on seeing the tempting morsel, the Jays alight on it, and while they are busily engaged in devouring it, the woodcutter gives a smart blow to the end of the pole within the hut, which

seldom fails to drive the birds high in the air, and not infrequently kills them. They even enter the camps and would fain eat from the hands of the men while at their meals."

Possibly no bird has keener vision or sharper ears than the Canada Goose, which in its wild state is said to be vigilant, suspicious, and hard to be surprised, yet it is often easily and quickly tamed. There were in Cleveland nearly forty of these geese, which were descended from a smaller number introduced about thirty years ago. Their migratory impulse was completely lost, and their sense of fear subdued, but their other wild instincts remained. They lived mostly in the parks, going from one to another as the spirit moved them, and bred on the small artificial islands in artificial ponds. I often heard their *honk!* as they flew over the city at night or in early morning, and saw their "harrow" or "triangle" which plowed the air by day often within bow-shot from Euclid Avenue.

When the birds were feeding on a lawn you could walk among them and drive them like a flock of tame geese, but they hated dogs and took to wing or water the moment one was seen to approach. They once had the habit of alighting on the roof of a tall building near Wade Park, but after one of their number met with the mishap of falling down a ventilating shaft this practice seems to have been abandoned.

On one of his shooting excursions Audubon shot a wild goose, and on his return sent it to the kitchen to be prepared for the table. The cook brought him an egg ready to be laid. This was placed under a hen, and in due time produced a bird, which became very gentle and would feed from the hand. When two years old it mated and reared a family.

We have seen how fear may vanish before the surge of the parental impulse which impels a bird to seek, nourish, and defend its offspring, even at the risk of life itself, and will now consider how this instinct may be used in taming wild birds at the nest and in bringing them to the hand.

If young birds of those species in which the parental instincts are very strong are taken from the nest when nearly ready to fly, the old birds, especially if they be among the class

of tamer individuals, may be brought direct to the hand in a short space of time. To their excited vision men are as walking



Fig. 142. Young Cedar-birds in displaced nest standing in characteristic attitude with upturned heads. Photographed on day of flight, July 17, 1899, when possessed of fear. For account, see page 98.

trees. Their attention is riveted on the young, and the man is nothing to them, provided he remains quiet, or moves about with caution. Whatever fear remains is blocked by the stronger instinct to go to their young.

Every occasion on which the tent described in these pages is brought up to a nest of young birds is a direct experiment in the taming process. No matter how far the discipline is carried or



Fig. 143. Female Chestnut-sided Warbler approaching nest and looking in. At this time there were eggs, or the young had barely pipped the shell.

how little permanency it may possess, the principle is always the same. By this method wild birds, while the parental instincts are at their height, can be tamed to a degree without use of a cage. In illustration of the process, we will choose the Chestnut-sided Warbler, although the experiments to be described were not carried out with this end especially in view. In any case parental instinct was the chief agent employed.

Two nests of the Chestnut-sided Warbler, each containing fresh eggs, were found in a pasture on the twelfth day of June. The behavior of the birds at both nests was at first essentially the same, so far as it was tested. While the eggs were still fresh, the nests were often visited without seeing or hearing a bird, but during incubation the female, who is a close sitter, would allow me to approach within a yard or two feet. Then as I extended my hand slowly toward her she would hop out and cling with head

down on the farther side of the nest, so that only her little tail was visible over its rim. Any one prone to discover protective mimicry in such cases would find a striking example of it in this attitude,—the little gray tail of the bird simulating so well one of the twigs which helped to support the gray wall of the nest. It was rather the case of an alert animal lying still or in hiding until a present danger might be past. If you kept your position long enough, the bird would drop to the ground, where joined by her mate both would hop about in the



Fig. 144. Female Chestnut-sided Warbler inspecting her young after having served food.

grass *chipping* nervously, but keeping well out of sight. On approaching one of the nests still later when there were young, the female was usually overtaken in the act of brooding. At such times it was easy to walk slowly to the nest and place your hand close to the brooding bird. But before allowing you actually to touch her, she would flit to the grass, and with spread wings and tail practice that "art of feigning" as it is usually called, although it is not an art or anything learned or practised for the occasion, but an inherited instinct, the end and advantage

of which is to distract your attention from the nest to the moving bird. One day I stood by and watched the little mother to see how long her antics would last. She would come within a yard of my feet when I remained perfectly quiet, and trail her wings along the ground, making repeated sallies back and forth, flying only when close pressed, and then always away from her nest. On one occasion this was kept up from ten to fifteen minutes, and did not cease until I withdrew.

My experiments at the first nest were begun on June 12th, by clearing away the bushes in front. The tent was set up two feet away on the morning of the 15th, while the little hen was still sitting over the eggs. She would dart out of the nest return and take a peep inside, sit for a few minutes and be off. When all was quiet, she could be seen jumping in and out repeatedly, as if equally uncomfortable whether away from her treasures or hugging them close. In the course of half an hour it was easy to photograph the sitting bird, who now paid little heed to the shutter, and remained undisturbed on the nest during my preparation for leaving.

On the following day the old bird was still persistently sitting, and even allowed me to erect the tent close beside her without budging. When finally driven off by the hand, she uttered a few *tseeps* and returned in a moment. Once the male came, and as I supposed placed an insect in the nest, when his mate, who stood close by, hopped to the brim, put down her head, and as I thought ate the food, but no, she was feeding the little ones, for she was now a mother. Four young birds, scarcely bigger than bumblebees, had just emerged from their shells. They must have been hatched since noon of the previous day.

On the third day these Warblers paid no attention to either the tent or the operator, and before going away I was able to touch the bird on the nest, though not without sending her off. The fourth day found their confidence undiminished, for the sitting bird eagerly seized a grasshopper which I offered from the hand stretched through the tent window. Four days later still I spent nearly seven hours with these Warblers, and in the afternoon began to test more systematically the strength of the

intimacy which we had cultivated. Taking a long twig in the hand and reaching through the window in the front of the tent, I touched the old bird. She resented this but little, and when her back was scratched seemed to like the sensation. Then I left the tent to look for insects, and after a long search returned



Fig. 145. Offering grasshopper to a Chestnut-sided Warbler who has been tamed without use of a cage. It was possible to approach this bird and stroke her back with the hand, without giving alarm.

with a few small grasshoppers. When one of these was offered, the bird would eye the squirming insect and try to seize it when held within reach. Wishing to economize, I held on to the insect and nearly pulled the bird off the nest.

After discarding the tent I was able to walk up to this bird and stroke her back with my hand without disturbing her in the least. Setting up the camera outside and attaching a tube with pneumatic bulb at the end, I made a number of photographs

which show the Warbler sharply eying an insect and prepared to seize it when held a few inches away. It would have been an easy matter to take her in the hand, though possibly not without injury to the young. Their early flight from the nest cut short any further experiments, but what could not have been done with a bird who had become so tame and confiding in the course of a few days?

The foregoing account does not necessarily imply that a wild bird can be induced to remain docile in the presence of man for any great length of time while still enjoying the freedom of its wild life. If the lesson learned is to be a permanent acquisition, it must be often repeated, and no other teachers allowed to interfere. To effect this the animal must, as a rule, be placed under restraint or in a cage, where its experiences are more uniform, more limited, and under perfect control.

In free life a new habit must struggle with other competitors and is liable to be suppressed quickly. However, I think it has been clearly shown that in the beginnings of the taming process which have been illustrated, where no physical restraint is used, the sense of fear must be combated by a stronger and contrary impulse, such as hunger or the parental instincts, which will lead the bird to undergo new experiences, and finally to adopt new habits.

That many birds become tame in a state of nature is well known and the subject is full of interest. The Pine Grosbeak is as good an illustration of the fact as may be found in this part of the world. I remember meeting a flock of these plump, stalwart-looking birds in a grove of sapling pines on the last day of February. The woods on every side were hoary with snow which had been falling for hours. When a young pine drooping under its weight of snow suddenly blossomed with a bright company of these birds, you might travel far to find a more attractive winter picture. A bird would sometimes drop on a branch, and settle down as if going to sleep. Then suddenly aroused by the desire for food he would sidle to the end of the bough, pick out the terminal or largest bud, twirl it between his stout cone-shaped mandibles to get rid of the scales, and then swallow the

resinous morsel. After seeing this experiment performed a good many times, I selected a handsome male, walked up to him, and caught him with my hat, as if he were a butterfly. When I stooped to pick him off the snow, he squeaked and struck vio-



Fig. 146. Chestnut-sided Warbler family. The male, perched above, has just delivered an insect to his mate, who quickly passed it to the young and continued to brood.

lently with his beak, uttering a peculiar *car-r-r-r-r!* When placed on the snow again he flapped about for a few moments resisting every attempt to take him, and finally rose and disappeared among the snow-laden trees. There were about fifty birds in this flock and the grove resounded with their clear whistled notes. They were easily approached at all times and in all weathers, during the early weeks of their visit, agreeing in

this respect with the Bohemian Waxwing, the Arctic representative of the Cedar-bird.

This tameness found among many Arctic species has been met with on a much wider scale in remote oceanic islands, where man is almost unknown and where the conditions of life are very different from those of the mainland. Darwin remarks¹ that the most anomalous fact on this subject which he had met was the wildness of certain small birds in the Arctic portions of North America, while some of the same species were said to be tame in their winter quarters in the United States. "How strange it is," says he, "that the English wood-pigeon, generally so wild a bird, should very frequently rear its young in shrubberies close to houses!"

Respecting the wildness which birds exhibit towards man, Darwin could find no way of accounting for it except as inherited habit, but in another work, he thus refers to the same subject²: "If we look to successive generations, or to the race, there is no doubt that birds and other animals gradually both acquire and lose caution in relation to man and other enemies; and this caution is certainly in chief part an inherited habit or instinct, but in part the result of individual experience."

The observations which have been made on the behavior of old and young birds do not support any theory of the inheritance of habits to account for tameness in animals, but as already shown afford a better clue of how this has been brought about. Let us go back to the Pine Grosbeak which, when fresh from his sub-Arctic home, can be approached and caught with your hat as could many of the birds in the Galapagos Islands when Darwin visited them in 1835. So far as I know, no one has studied the young of this species in the nest and ascertained whether they show the same instincts of fear in general toward strange sights and sounds, as we find in passerine birds nesting farther south. Assuming that they do, and there can be little doubt of it, the instinct has lapsed through disuse in adult life, although the capacity of expressing fear remains and may be

¹ *Journal of Researches*, chapter xvii.

² *The Descent of Man*, p. 80.

quickly aroused and directed towards particular objects. The timidity of this bird in March after a brief experience with the ways of men is therefore virtually an acquired character, and there is no evidence that it is handed down by inheritance.

The breeding range of many northern birds covers a vast area, and in different sections there is reason to expect much variation in the habits of the same species. The timidity of the Arctic birds referred to may have been due to local conditions affecting a relatively small number, or the birds may have been young individuals whose intuitive fear had not been worn away, or old ones possessed of a wisdom derived from extensive travel southward. Among birds which are reputed to be shy, tamer individuals are to be found, and many acquire the habit of nesting in gardens and often close to houses. In the Galapagos Islands, where birds had lived in comparative security for ages with no fierce and relentless enemies to mar their tranquillity, the instinct of fear had not only lapsed, but the power of forming new habits had weakened. It is therefore not surprising that they should be slow in acquiring a fear of man, but any animal which finally fails in the face of constant persecution to profit by experience has touched the lowest depths of stupidity, and its days are numbered.

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